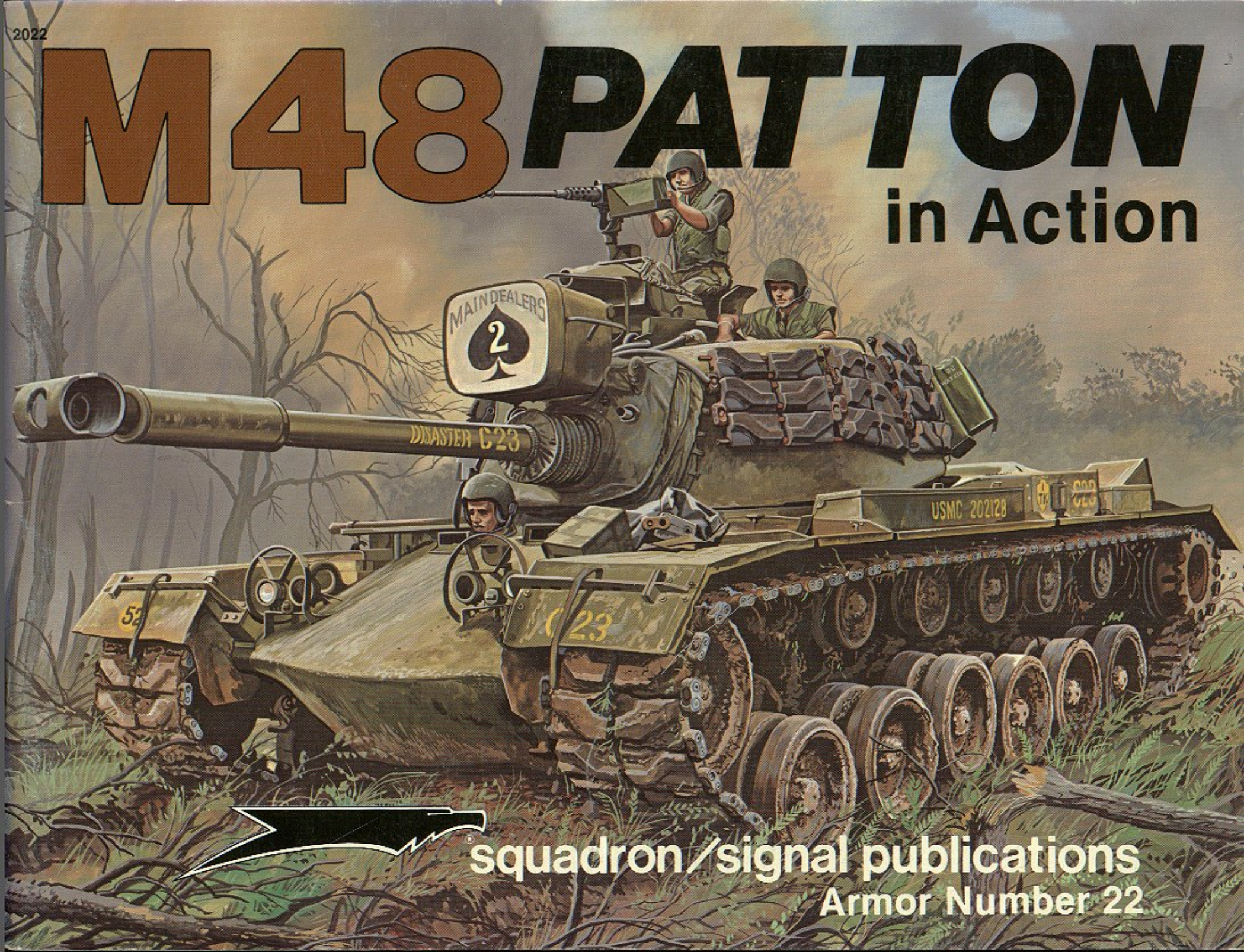
2022

M48 PATTON in Action



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Armor Number 22

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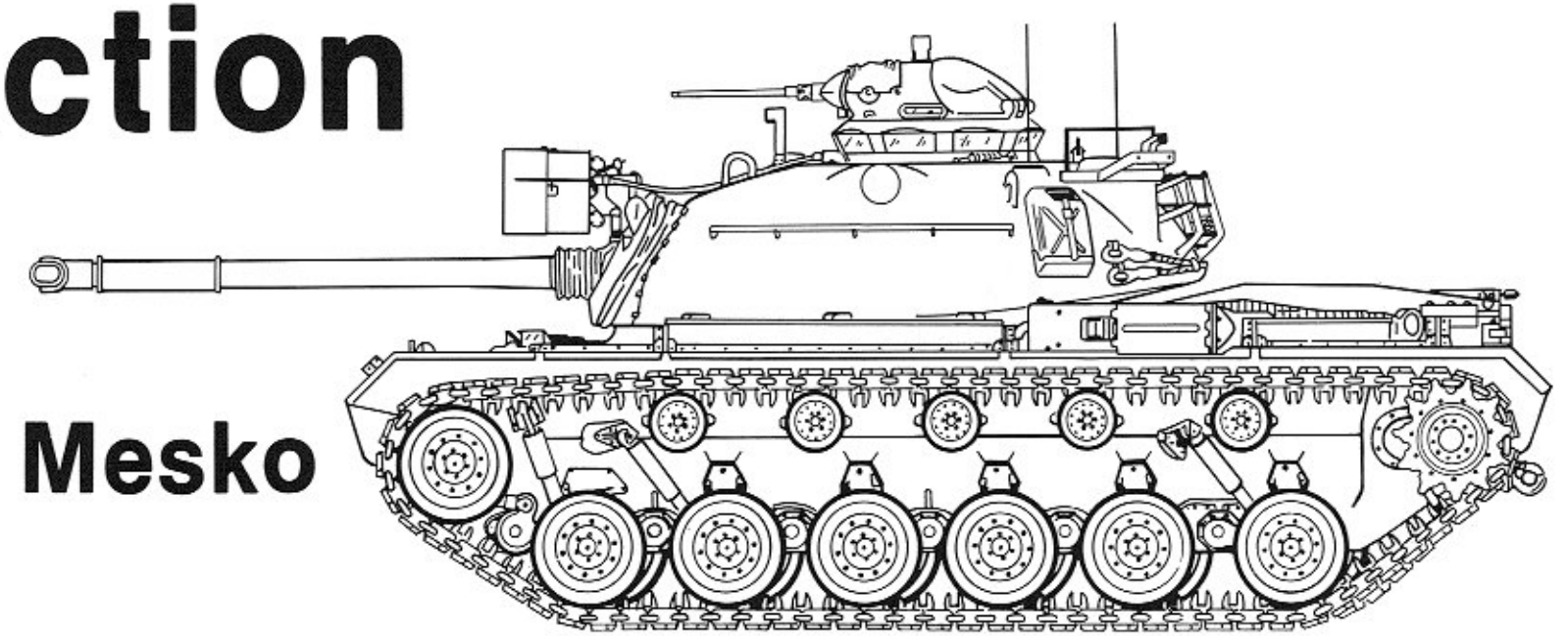

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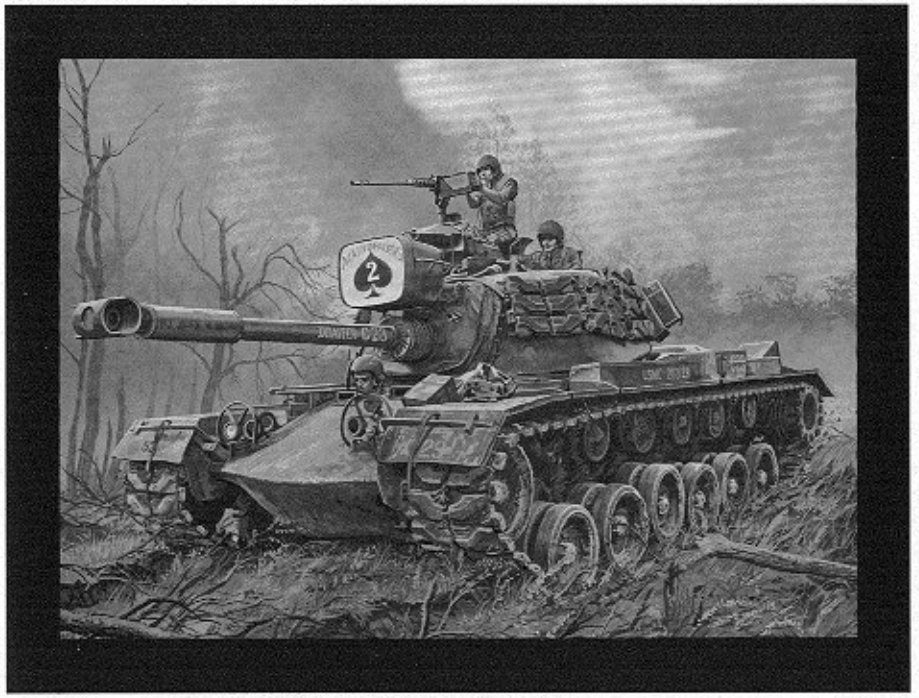

DISASTER a M48A3 (late model) Patton of the MAIN DEALERS, 2nd Platoon, 'C' Company, 1st Marine Tank Battalion, during operations Southeast of Da Nang in February of 1970.

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(Right) This late model M48A3 is an excellent example of Pattons in Vietnam. This vehicle sits behind a wire fence in a night defensive position near the 'Rockpile' in I Corps while supporting elements of the 101st Airborne (Airmobile) Division during the spring of 1971. The cupola mounted machine gun has been removed and a .50 has been mounted atop the cupola. A G305 riser has been added under the cupola turret and a searchlight has been mounted in case of a night attack. The large amount of extra gear on the outside of the tank is quite typical of that carried on tanks during a conflict; extra ammunition, C ration boxes, coolers, bogey wheels, spare track, and additional fencing wire can be seen scattered over the vehicle. (US Army)

Introduction

At the end of World War Two, the United States possessed a large, experienced armored force, which was concentrated primarily in Europe. The backbone of this armored force was the M4 Sherman medium tank, which also constituted the bulk of our allies' armored strength. But while the Sherman was a robust and mechanically reliable vehicle, by 1945 its thin armor and main armament were decidedly inferior to the latest German and Russian tanks. The final version of the Sherman, the M4A3, somewhat redressed this imbalance with the addition of a high velocity 76MM cannon, but the basic design had just about reached its limits.

M26 PERSHING

During World War II the US Army had worked on a number of designs to supplement the Sherman, but through a lack of foresight and philosophical stupidity these new designs were not pushed along until the latter part of 1944, when the battlefield situation in Europe was desperate for a more heavily armed and armored tank to counter the increasing number of German Panther and Tiger tanks being encountered. As a result of this the new M26 General Pershing *heavy* tank was rushed to Europe in the closing months of the European conflict to aid the outclassed Sherman. With its 90MM gun and well designed ballistic shape the Pershing acquitted itself well in the few contacts it had with German armor before the war ended.

Following the Nazi surrender in Europe, US Army officials were able to examine in detail the latest strides in German tank development. In addition, these same officers saw the latest Soviet armor, most of which totally outgunned current allied tanks. But while these discoveries prompted concern, the sudden appearance of the atomic bomb in August of 1945 caused this concern to diminish, since most ranking officials, both political and military, saw the beginning of a new era in warfare. Most American political and military leaders felt that conventionally equipped armed forces were a thing of the past. With the surrender of Japan, the United States rapidly began to demobilize the huge military machine created to defeat the Axis powers. Little thought was given toward modernizing those forces that were to remain, except for the Air Force, which, with its new atomic *strategic deterrent* weapons, was now considered to be the main battle force. Fortunately a great deal of usable equipment had been mothballed, including large numbers of M4 Shermans on the *outside* chance that they might be needed someday.

During the immediate post war years little attention was given to developing a replacement for the M26 Pershing, which had been re-classified as a medium tank. As the Pershing slowly began replacing the older Shermans, the M4s were largely relegated to training duties, or assigned to reserve and national guard units. A few Shermans, modified for special duties, as armed bull dozers, flamethrowers, or infantry support tanks, were kept in front line service since they adequately fulfilled these roles and no replacement was available. By 1948, however, the initial euphoria which followed the end of World War Two had disappeared as the *cold war* intensified between the United States and the Soviet Union. This led to attempts at modernizing American armored forces stationed in Europe to counter the ever growing communist forces in Eastern Europe.

M46 PATTON

The main thrust of this attempted modernization was concentrated on upgrading the 45 t (ton) M26 Pershing, which had the same power train as the earlier 35 t Sherman, and experienced considerable engine and transmission problems. The resulting upgraded Pershing, designated the M26E2 had a new General Motors CD-850-1 cross-drive transmission and was powered by a 740hp Continental Motors Corporation aircooled V-12 AV-1790-1 gasoline engine. The new cross-drive transmission combined the functions of a transmission, a braking system, and a steering system. Although unforeseen at the time, this transmission and engine combination would form the core of American tank development for the next three decades. A bore evacuator was added to the 90MM gun, and a single baffle muzzle brake replaced the double baffle. An M83 telescopic fire control system was added. This modernized version of the Pershing was re-designated M46 on 30 July 1948, and at the same time the older M26 Pershings were re-classified as *Limited Standard*. A production order for 800 M46s was placed and plans were made to modernize 1215 M26s to M46 standards. The M46 was nicknamed the *General Patton*. Production M46s were powered by a Continental AV-1790-5.

While the M46 program did help upgrade the US Armored forces, the Army realized it was only a stop gap measure. In 1948, authorization was given to start a new design program for an inter-related family of three tanks in the light, medium, and heavy categories under the designations T41, T42, and T43 respectively. Though the T41 and T42 shared a very similar chassis the T42 had a heavier turret fitted with a more modern 90MM gun. All three designs progressed at a leisurely pace.

However, in June of 1950 the North Korean army, spearheaded by 150 Russian built T-34/85s, invaded the Republic of Korea (ROK).* The North Koreans quickly broke through the South Koreans who had no weapons capable of stopping the heavily armored T-34s. Many ROK troops, never having seen a tank before, fled in panic. American troops, under United Nations control, were rushed to Korea to stop the North Korean onslaught. Com-

** For a history of armor in the Korean war see the author's ARMOR IN KOREA, Published by Squadron/Signal Publications*

The backbone of US armored forces during World War Two and Korea was the M4 Sherman. Reliable and robust, it was continually updated. This variant, the M4A3E8, featuring a high velocity 76MM cannon and the improved horizontal volute spring suspension (HVSS), was the highpoint of American development of the M4 series. During the Korean War the Sherman was one of the main tanks used by armored units. This vehicle is from the 89th Medium Tank Battalion which was attached to the 25th Infantry Division. (US Army)

During the early days of the Korean War the North Koreans used a large number of Russian built T-34/85 to spearhead their drive south. To counter this well armed and armored tank the US rushed Shermans and M26 Pershings from Japan and the United States. These Marine M26 Pershings have just rolled into a resupply dump to refuel and rearm. In their first encounter with the T-34 Marine tankers scored a resounding victory over the much vaunted Russian vehicle and destroyed the myth of invincibility which the T-34 had fostered among US and Korean infantry early in the war. (USMC)

mitted piecemeal, and without adequate anti-tank weapons or tank support, initial American troops were also overrun. Eventually enough M4 Shermans and M26 Pershings were scraped together to stop the T-34s. But, while both tanks proved capable of handling the Soviet T-34/85, events during the early days of the war sent shock waves through the entire US tank program.

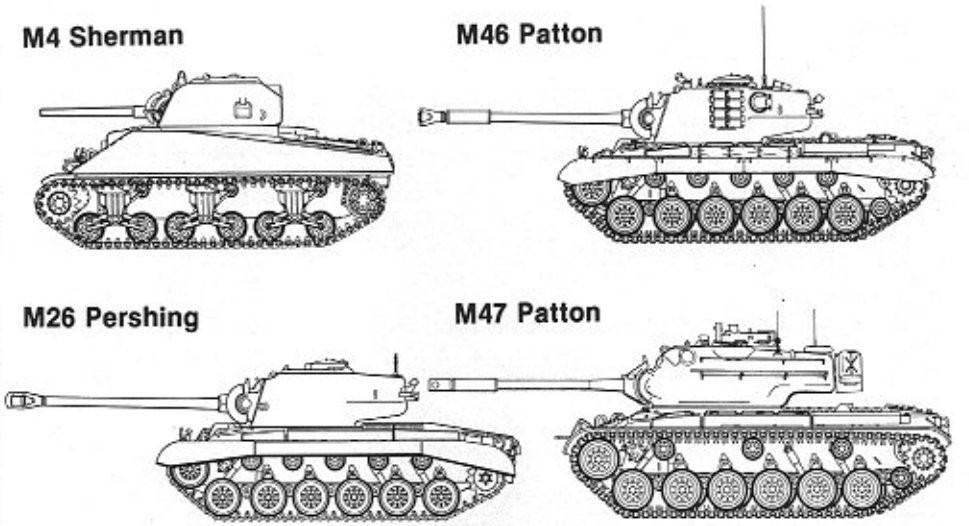
When the Korean War broke out the M26 to M46 conversion program was in full swing but the Pershings rushed to Korea seriously depleted the numbers planned for updating to M46 standards. Since many of its features were already considered obsolete it was decided not to initiate new production of the updated M46. However a number of M26s were converted to M46 standards, and on 8 August 1950 the 6th Tank Battalion arrived at Pusan, Korea bringing the first M46 General Pattons into the combat zone.

M47 PATTON

At the outbreak of the Korean War the experimental medium T42 was still unavailable for testing. Work on the design was pushed forward but the resulting vehicle was found to be underpowered. However, the T42 turret offered improved ballistic protection, a better layout, and a more sophisticated rangefinder than the M46. In an emergency move it was decided, under political pressure, to mate the turret of the experimental T42 on the proven M46 chassis under the designation M47. Unfortunately, while much was expected of this interim tank, the haste at which it was pushed through testing and into production caused serious problems, primarily with the new turret. The new stereoscopic rangefinder never lived up to expectations and further problems arose when adequate supplies of rangefinders were not forthcoming. As a result the M47 was declared Limited Standard and never saw action in the Korean War where the M4 Shermans, M26 Pershings and M46 Pattons carried the load of fighting until the cessation of hostilities in the summer of 1953. The M47 was initially given the name General Patton II but later was changed to Patton 47. The first M47s issued went to the 1st and 2nd Armored Divisions in order to upgrade their ability to deal with the growing Soviet build-up in Eastern Europe. The M47's service in American armored forces was to be shortlived since a new design, the M48, was now going into production. By 1955 the M47 had been declared Limited Standard.

As a result of being designated Limited Standard, the bulk of M47 production, over 8000 vehicles, were exported to US allies in Europe where they formed the backbone of Western European armored forces for nearly fifteen years. NATO countries in particular, were among the major recipients of the M47 Patton with Belgium, Germany, France, Greece, Italy, Portugal and Turkey receiving over 7000 of them. In addition Austria, Spain and Yugoslavia, while not NATO members, took delivery of over 800 tanks. The French were the first to take their M47s into combat when a squadron of the 8th Regiment of Dragoons was deployed during the 1956 Suez invasion. Later Turkey used her M47 Pattons during the invasion of Cyprus in August of 1974 where they saw action against T-34s, and Spain employed a battalion of M47s when trouble arose in the Spanish Sahara in 1974.

Outside of Europe M47s were purchased by Ethiopia, Iran, Jordan, South Korea,



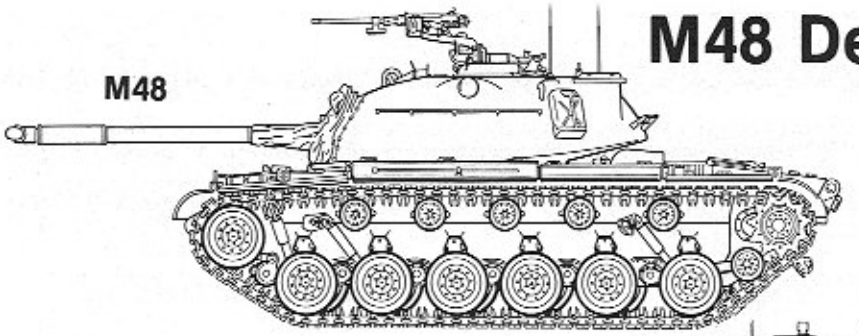
Pakistan, Saudi Arabia, and Taiwan. Many of these saw combat in various regional clashes which took place in, and around these nations. Iran, in conjunction with Jordan and Pakistan, set up a modernization facility to upgrade the engine, transmission, and generally improve the tank's basic layout. Designated M47M, these updated Patton 47s were pressed into use by the Iranians during the war with Iraq. Because of King Hussein's backing of Iraq, Jordan did not receive any of her rebuilt M47Ms. Some 150 Pakistani Pattons were modified before the modernization line in Iran closed down. Pakistan employed Patton 47s during the 1965 conflict with India where many were lost due to poor tactical planning rather than any inherent deficiencies in the vehicle itself.

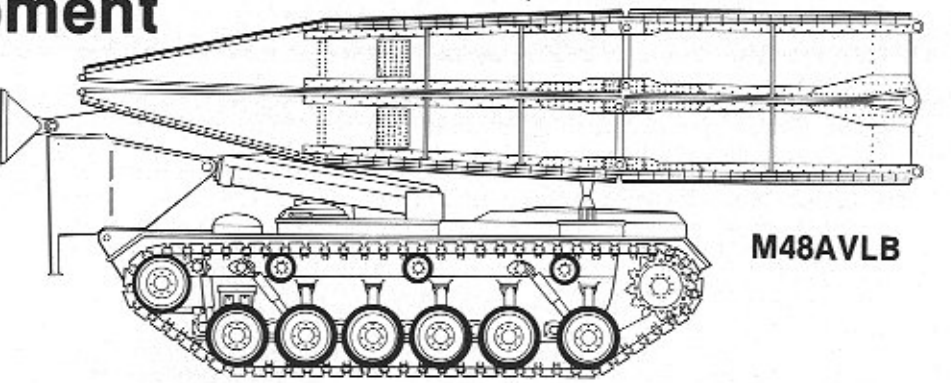
By the 1970s, despite some attempts at upgrading, most countries using the M47 had relegated it to reserve forces or the scrap yard. Austria has employed its M47 turrets as fixed pillboxes along its borders. The days of the M47 Patton are nearly at an end, and the few nations still using them are re-equipping with more modern battle tanks.

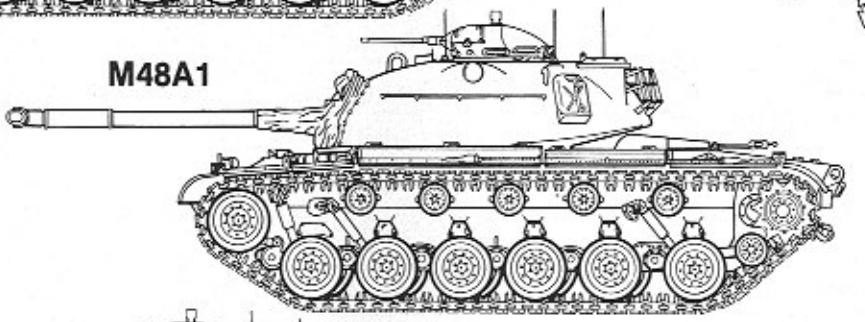
A postwar development of the Pershing was the M46 Patton which was basically a rebuilt M26. These vehicles had a new engine and transmission, improved suspension and fire control system, a bore evacuator for the main gun, and a revised engine deck. (USMC)

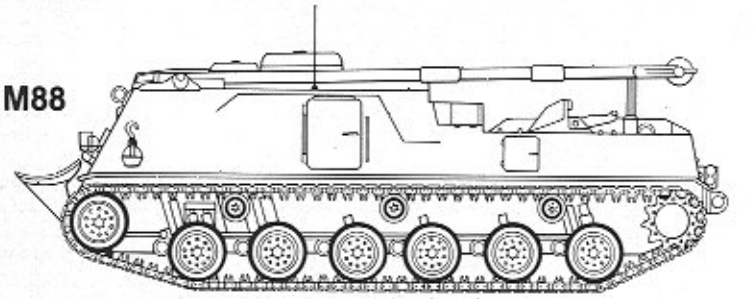
The Korean War jolted the United States into the reality that its armored forces needed serious updating. As a result funds were channeled into new research. The experimental T42 did not live up to expectations, but its turret was found to be better than the one used on the M46. As a result the army decided to mate the new turret to an M46 hull which resulted in the M47 Patton. Unfortunately the new turret had many problems and the new tank never lived up to expectations. These M47s of the 2nd Armored Division, are taking part in OPERATION MONTE CARLO maneuvers in Germany during 1953. The 1st and 2nd Armored Divisions were the first units to receive the new tank in 1952. (US Army)

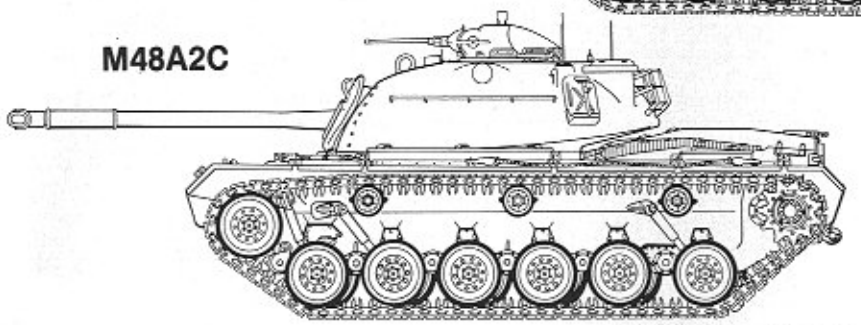
M48 Development

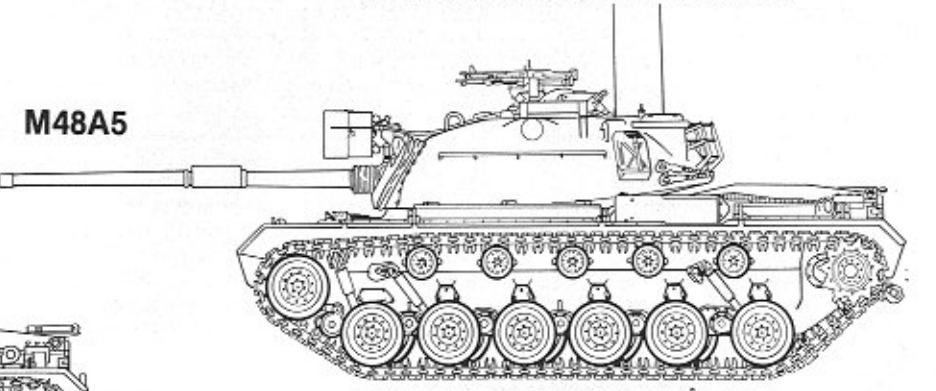


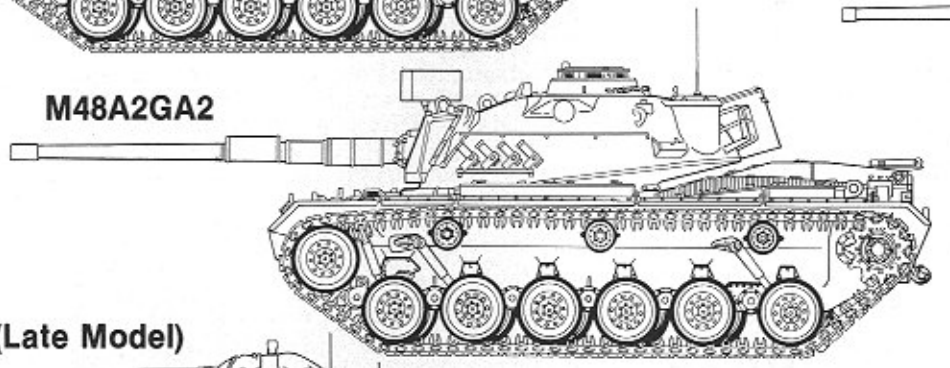


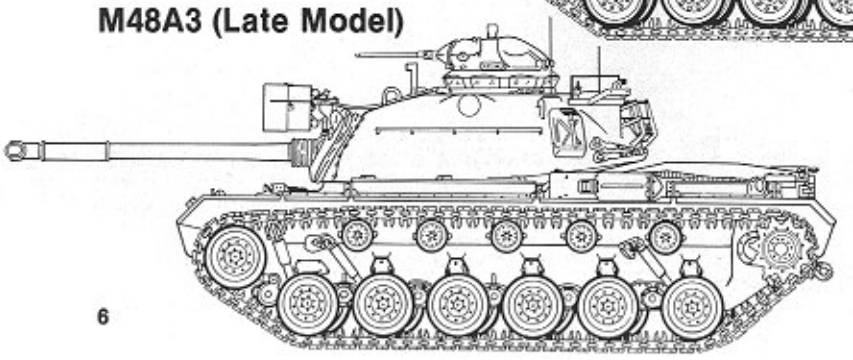


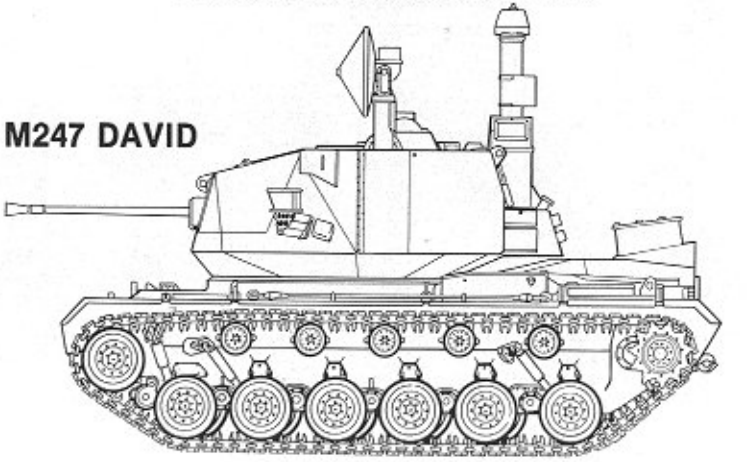












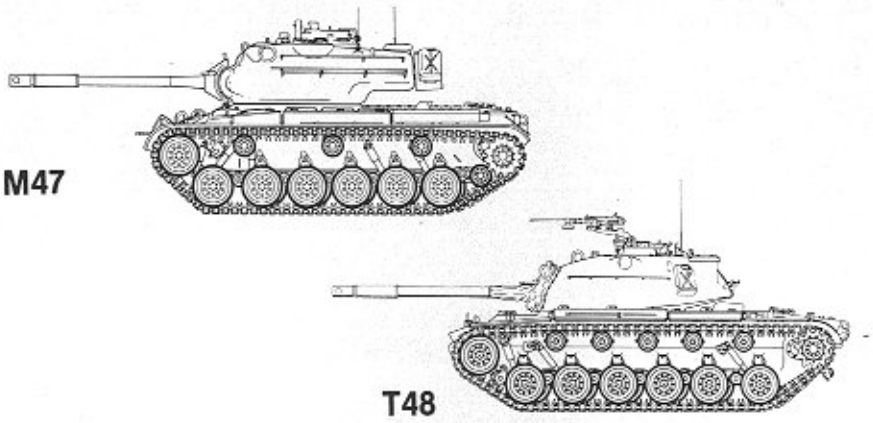
T48 Development

Since the M47 was considered a stop-gap measure, even as it was taking shape, steps were underway to develop a replacement for it. In October of 1950 the Detroit Arsenal began a study that resulted in a medium tank design concept that was basically a shorter and lighter version of the experimental T43 heavy tank design, the outstanding feature of which was an elliptical hull. In December, after reviewing the resulting report, the army issued an order to Chrysler Corporation for six prototypes under the designation T48, the first of which was to be completed within one year. The sixth pilot T48 was to go to the US Marine Corps. The speed at which these pilot vehicles were rushed through development and testing reflected the army's shock over initial encounters with Soviet T-34/85s during the early days of the Korean War, and the Army's desire to get a more modern tank into production as quickly as posible in order to counter the constantly growing Soviet threat to Europe.

The new vehicle, built around the proven engine and transmission used by the M46 and M47, retained the large 85 inch diameter turret ring of the T43, which allowed the turret walls to roundly slope down, providing excellent ballistic protection. A 90MM T39 gun with a quick change barrel was installed as the main armament. Secondary armament consisted of two machine guns, a .30 caliber co-axial machine gun mounted to the left of the cannon, and a remote controlled .50 caliber machine gun mounted in the tank commander's cupola which could be fired from inside the tank, although the commander had to expose himself to reload the weapon. All around vision was provided by four periscopes. The crew was reduced to four by eliminating the redundant fifth crew member who had served as co-driver, radio operator, and hull machine gunner. Since there was no hull machine gun only the driver was positioned in the forward portion of the hull. The new hemispherical cast turret not only provided better protection, but was far roomier than either the M46 or M47. The wide turret ring allowed for the possible installation of a larger gun at a later date. The stereoscopic rangefinder of the M47 was retained even though it had proved difficult for crew members to operate. While the T48 carried fewer rounds than the M47 (60 versus 71), the rounds were more conveniently located which enabled the crew to more quickly select the type of round needed for a specific fire mission. A wider track was used and the track tension idler of the M46/M47 was eliminated. A new type of friction shock absorber replaced the older hydraulic system which provided the M48 with a better ride and longer service life. A steering wheel replaced the wobble stick control in the drivers compartment. When the cross drive transmission was put into the high or low range of gears the driver could turn the tank to the right or left by turning the steering wheel to the right or left, and when the transmission was in neutral the driver could pivot the vehicle in place with a full turn of the steering wheel.

Following completion of the pilot vehicles, but before completion of the test program, the army placed massive orders for the new T48. Chrysler Corporation received an initial order for 548 tanks while Ford Motor Company and the Fisher Body Division of General Motors each received orders for 400. The first production vehicles began leaving the assembly line at the new Chrysler tank plant at Newark, Delaware in April of 1952. Considering that the original contract for the new design had not originated until December of 1950, the speed with which the T48 was produced was amazing. Unfortunately, the Army felt that the world situation demanded the largest number of tanks at the earliest possible date, consequently T48s were ordered into production before the test program was complete. As a result the early T48s suffered numerous mechanical breakdowns and system failures which often rendered the new tanks inoperable. Many of these defects had cropped up during tests on the pilot vehicles, but the army's desire to get the T48 into service caused the T48 to go into production before many of the defects could be corrected. Special modification centers eventually had to be set up to which initial production vehicles were returned to correct these defects. Major problem areas included failures in the engine, transmission, tracks, and suspension. In addition, the stereoscopic rangefinder, though potentially far superior to the coincidence system, proved extremely difficult to operate, which resulted in disappointing performance. While these defects would eventually be ironed out, the first few years of the T48's life were anything but reassuring.

Due to the multitude of problems with the T48 program, the Controller General's office began an investigation of the program. Its report stated that early production vehicles were so riddled with defects that *...they were not acceptable even for training purposes.*

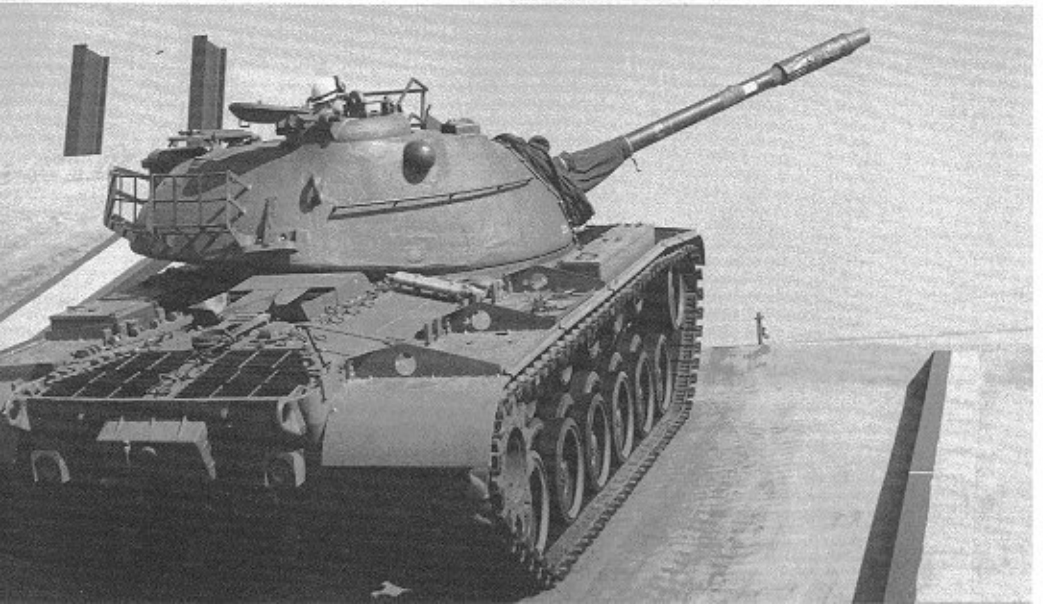


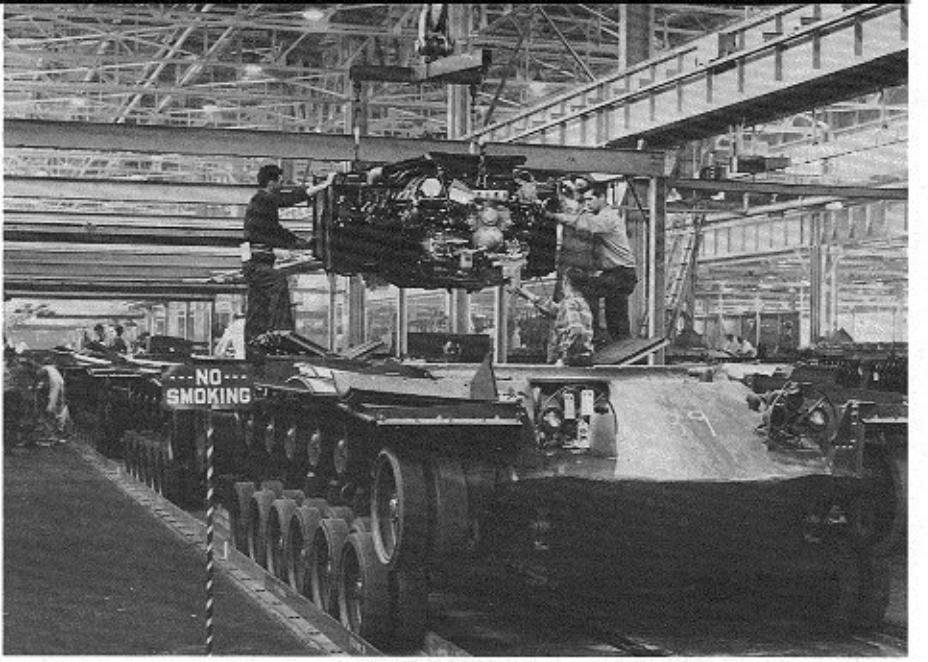
With the elimination of the co-driver only one crewman was located in the forward hull. The new boat shaped hull is very evident as is the hemispherical shape of the turret. A prominent feature of both the T48 and production M48 was the gun mount for the tank commander. (Chrysler via Binder)

While trials of the new tank started during the spring of 1952 it was not publicly unveiled until 1 July. At the ceremony the T48 was officially christened the PATTON by the widow of General George S Patton, the most famous American armored commander of World War II. (US Army via Binder)

And while the Army eventually accepted responsibility for the situation due to its desire to get the T48 into service, it also claimed that many of the problems with the new tank were the result of poor maintenance and crew indifference rather than any inherent design defect. Had production not been so rushed, this argument might have had merit. Any attempt at forcing a new design into production before adequate testing has found the bugs inherent in all new designs and time has been taken to re-design out these problems, will almost certainly result in near disaster, as the T48 program experienced.

An early production Patton is put through an incline test. The flat engine deck and angled rear hull are clearly evident. These features would be characteristic of the first two variants of the M48 Patton series. (GM/Thom Wagner via Binder)





Production of the new tank started almost immediately after the initial test vehicles were completed, but well before testing was completed. These assembly line men at the Ford plant install the big Continental 12 cylinder 4 cycle AV-1790-5B in a T48 chassis. Besides Chrysler and Ford, General Motors also produced the Patton. (Ford via Binder)

Unfortunately the rush to get the new tank into production resulted in a host of problems which took a great deal of time and money to rectify. Over 250 Pattons sit in a storage yard prior to being issued to the army. Due to the numerous defects special modification centers were set up to deal with the host of problems which beset the new design. (Ford via Binder)

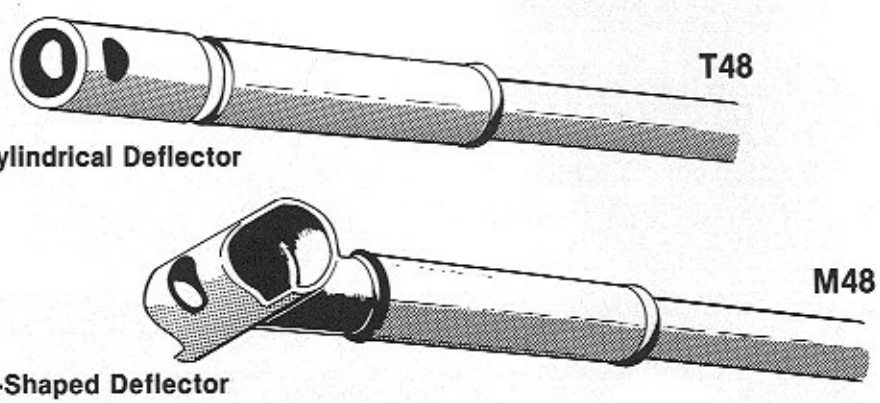
M48 PATTON

Despite all the problems with the initial production vehicles the Army decided to standardize on the T48 and in April of 1953 it was designated the 90MM Gun Tank M48 and named the Patton 48, by which time over 900 had been produced. During the production run some changes occurred in external fittings, but these were minor in nature. Early problems with the engine, transmission and suspension and tracks necessitated the setting up of modification centers to correct these various problems. However the high fuel consumption of the M48 Patton, which resulted in a range of only 75 miles, could not be so easily solved. An interim solution for troops in the field was simply to add a jettisonable rack to the rear of the tank to carry four 55 gallon fuel drums. For obvious reasons these fuel drums were used only to extend the tank's range outside of the combat zone, since the entire system was unarmored, and extremely vulnerable to enemy fire, creating a serious fire hazard if the vehicle ventured into a combat zone without jettisoning the fuel drums.

Since the Army was trying to cut down on the amount of dust raised when the main gun was fired early production M48s were fitted with a variety of muzzle brakes. Pilot vehicles and early production M48s had the cylindrical deflector that had been used on the M47. A single-baffle brake similar to the one used on the M46 was tried but it was dropped in favor of a T-shaped deflector which became standard on all 90MM armed M48s. However, the effectiveness of these muzzle deflectors was always questionable.

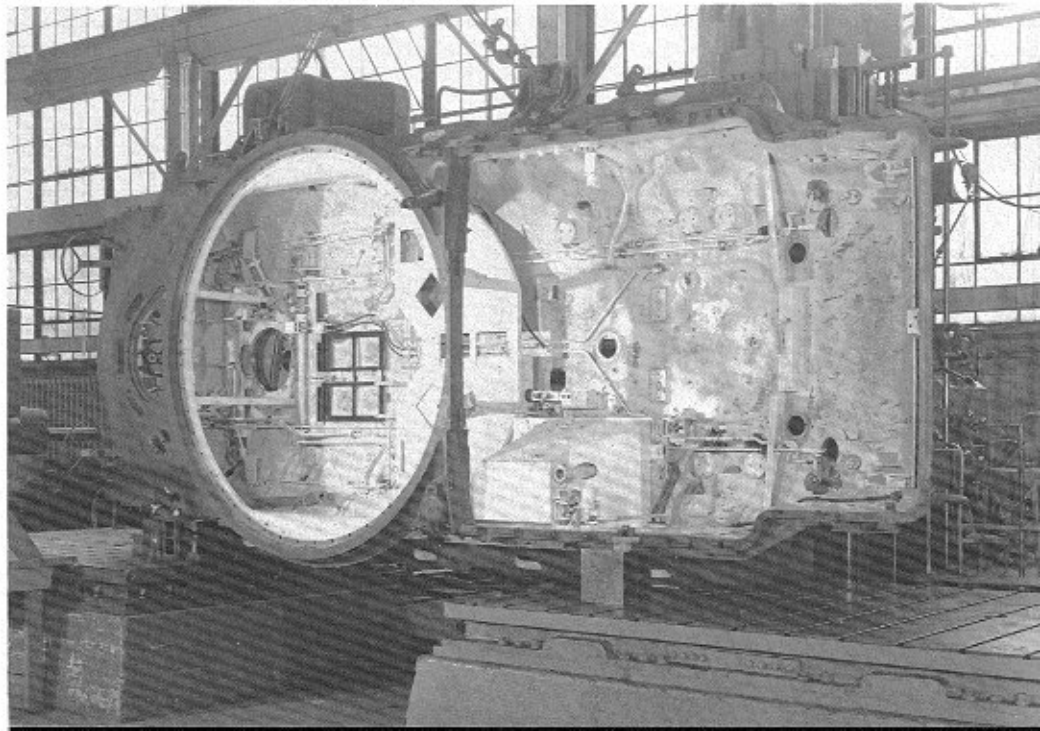
While the T48 and initial production M48s did not have a tension adjusting idler between the rear sprocket and the sixth road wheel as had the M46 and M47, this was later added to help alleviate the tendency of the M48 to shed tracks during a turn. And while this tension adjusting idler wheel did help ease the problem somewhat, throwing tracks remained a problem. Another distinguishing feature on late model M48s was the rounded fender extension on the front and rear fenders. The small driver's hatch and opening were redesigned and enlarged and installed on production vehicles as quickly as possible. With the older, smaller hatch the three periscopes automatically dropped down before the cover opened, but had to be manually pushed up to an operating position after the driver's hatch was closed. The new larger driver's hatch cover raised to clear the now permanently in place periscopes before being rotated to an open position. In August of 1953 a new fully enclosed low silhoutte commander's cupola turret designed by Aircraft Armaments Inc was approved for installation. A .50 caliber machine gun was mounted in the new commander's turret which could be aimed, fired, and loaded from inside the tank.

Muzzel Brakes



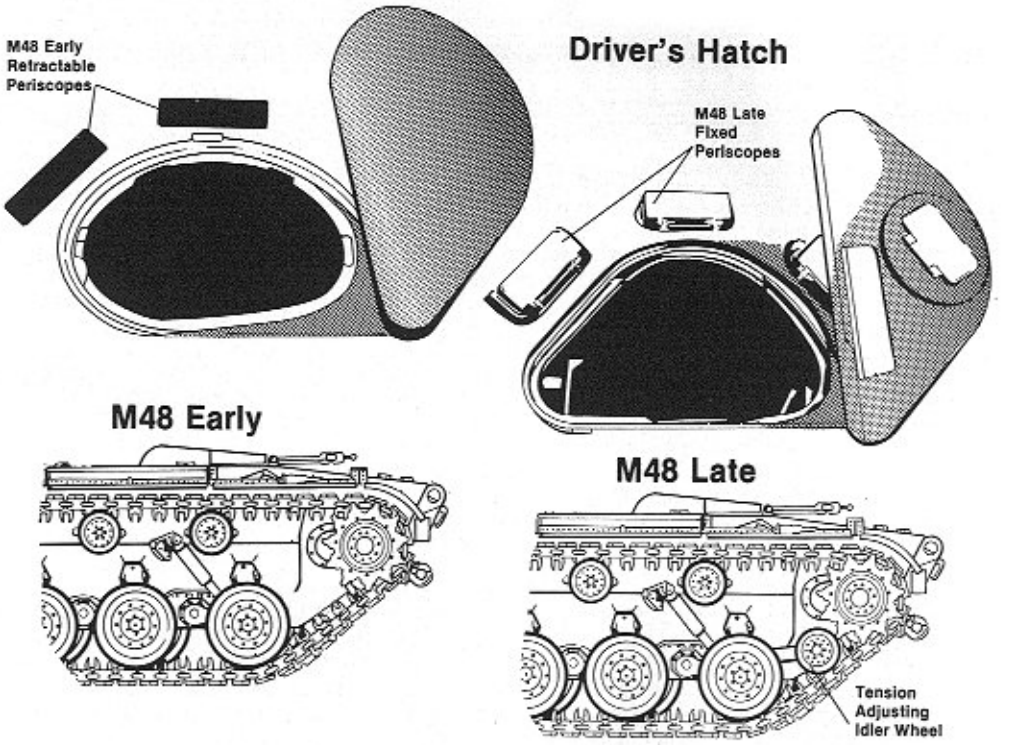
(Above) By the spring of 1953 the T48 Patton had been designated the M48 Patton. This Patton, along with other new armored vehicles, is on display for troops to examine. A characteristic of the early Pattons was the rounded fenders. (Rock Island Arsenal via Binder)

(Below) An M48 hull in a tilted position at the Rock Island M48 modification center. The oversized turret ring allowed the M48 to accept a large ballisticly well shaped turret with roundly sloping walls. (Rock Island Arsenal via Binder)

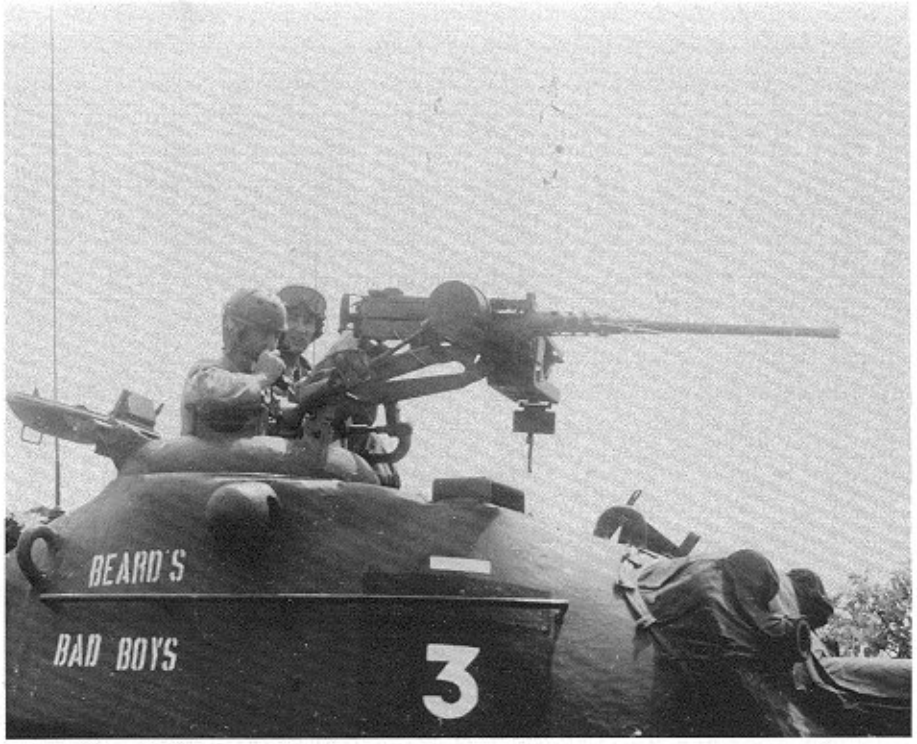


(Above) One of the most serious early problems of the M48 was its limited range due to limited internal fuel storage and high fuel consumption. To help alleviate this problem a jettisonable rack capable of holding four 55 gallon drums of fuel was installed which increased the tank's range considerably. (US Army via Binder)

(Below) The fuel was fed into the hull through a series of lines attached to the rear hull. The system was basically unarmored and presented a serious fire hazard in a combat situation, and was restricted to use in non-combat zones only. (US Army via Binder)



To provide some measure of protection a light metal shield could be raised to deflect small arms and shrapnel as well as deflect gasoline away from the vehicle. Prior to entry into a combat zone both the rack and fuel drums were to be jettisoned. (US Army via Binder)

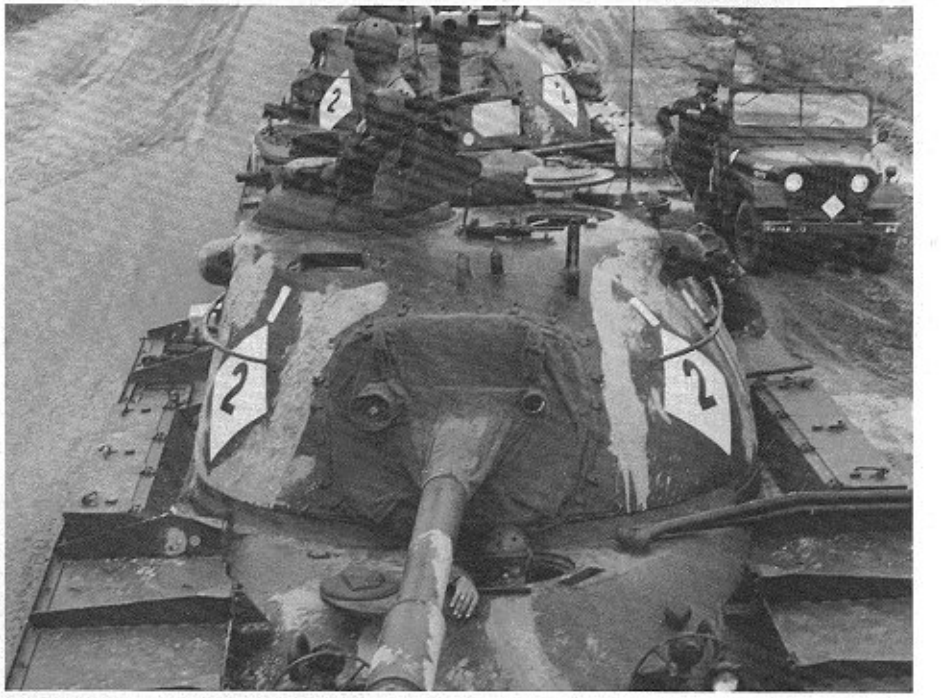


(Above) The delay in production of the M1 cupola resulted in the substitution of a simple, low profile tank commander's hatch with an externally mounted .50 caliber machine gun. (US Army)

(Below) Early in its career the M48 Patton was used to test the feasibility of various mine roller devices in an effort to improve mobility through mined terrain. Most of these devices consisted of a series of high resistant steel wheels which were supposed to absorb the shock of an exploding mine which it hit. A successful device was not really fabricated until late in the Vietnam War. The addition of a track tension adjusting idler behind the last bogey wheel helped to solve the problem of shedding tracks during a turn. (US Army)

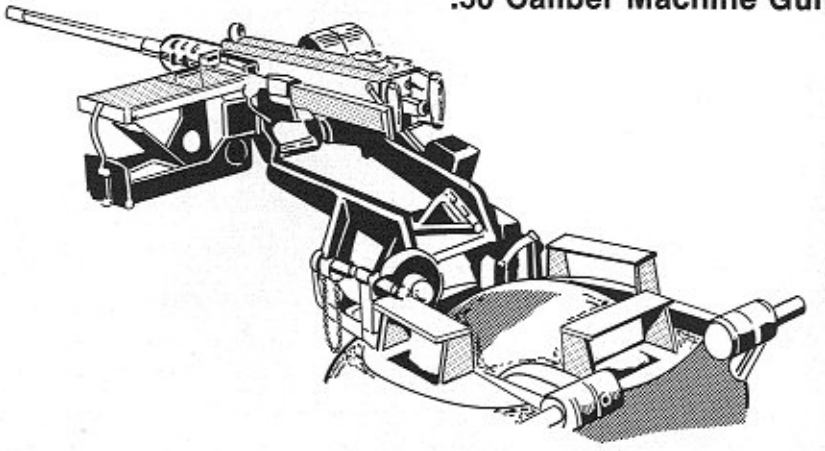
(Above) The M48 quickly became the main battle tank of the US Army during the mid 1950s despite all the problems which it exhibited. As these problems were corrected in the early variants or eliminated on later models the Patton gradually gained acceptance by the troops and turned out to be a robust reliable machine. These M48s from the 66th Armor Company at Fort Campbell, are taking part in 'Exercise Strike' early in 1960. (US Army)

The Marine Corps also began taking delivery of the new tank to upgrade its armored units. This early production Marine M48 moves inland along a road during an amphibious exercise. The cylindrical blast deflector was replaced by a T-shaped deflector very early in the production run. (Fred Ropkey via Binder)



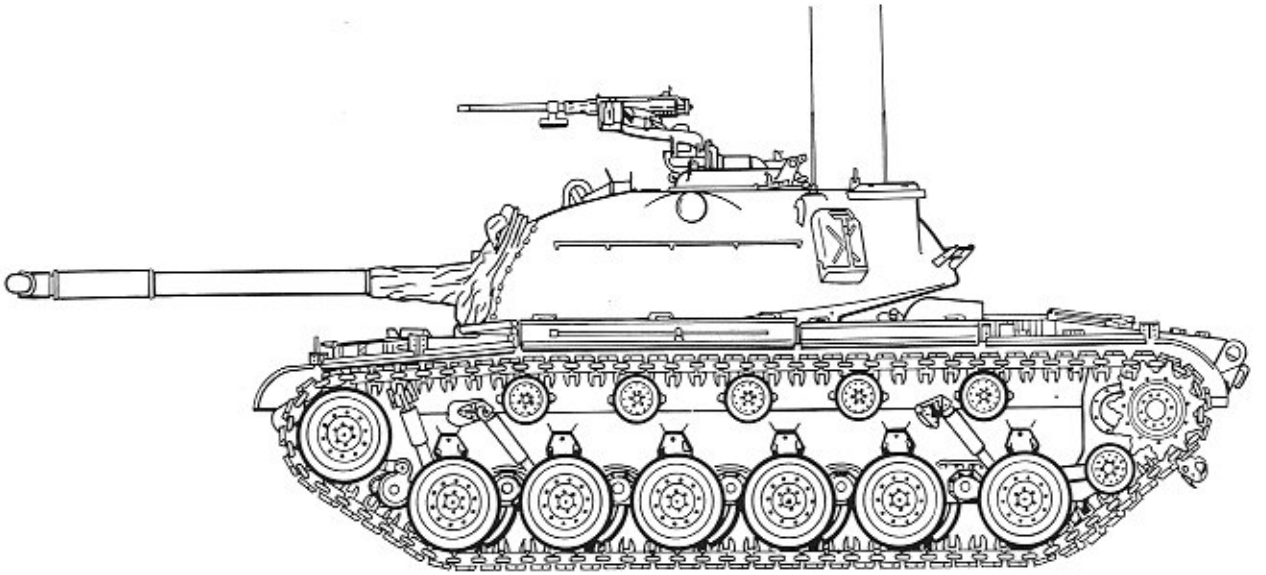
The .50 caliber machine gun on the cupola could be replaced with a .30 caliber machine gun. These Pattons are from the 1st Tank Battalion, 112th Armor, 49th Armored Division, a National Guard unit.The small driver's hatch with drop down periscopes identify the lead vehicle as an early production M48. (US Army)

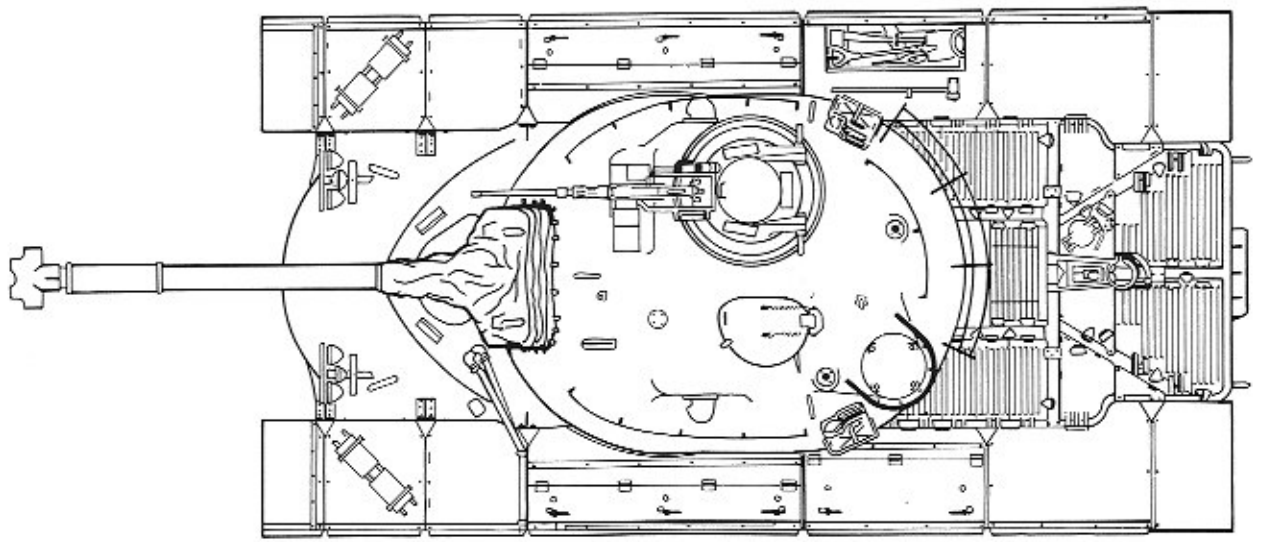
.50 Caliber Machine Gun

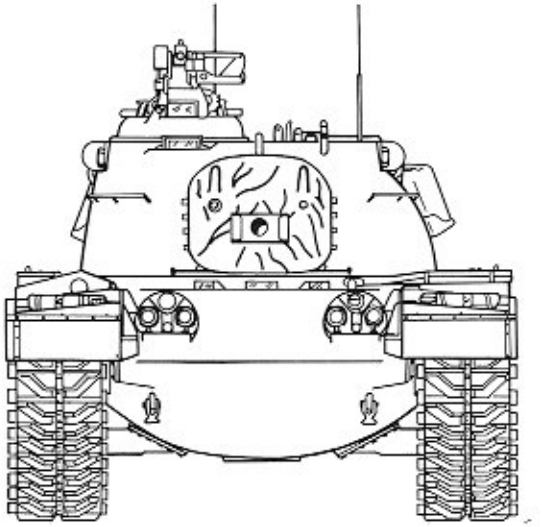


(Right) Eventually, many of the M48s were shipped overseas as military aid to American allies. This camouflaged M48, with a two-toned paint scheme, belongs to an armored unit of the Republic of Korea (ROK). (Vaughan/Haugh via Binder)

M48 90mm Gun Tank



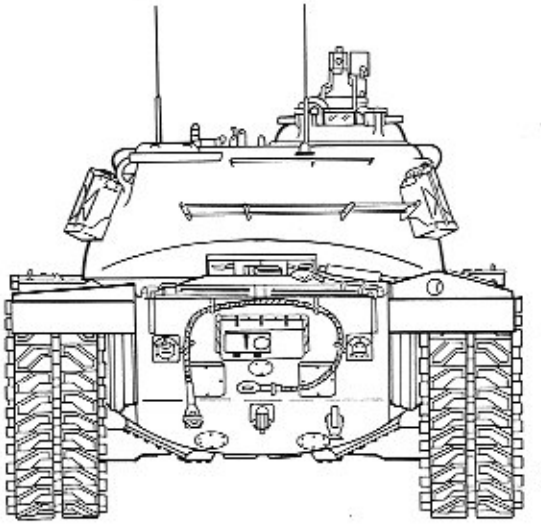




Specifications

90MM Gun Tank M48

Crew	4 Men
Length (gun forward)	346.9 inches
Width	143.0 Inches
Height (AA Gun)	127.6 Inches
Ground Clearance	16.5 Inches
Combat Weight	99,000 LBS
Armament	
Main	90MM Gun
Secondary	
AA Mount	.50 Caliber
Co-Axial	.30 Caliber
Engine	AV-1790-5B
Horsepower	704 HP
Maximum Speed	28 MPH
Maximum Range	70 Miles



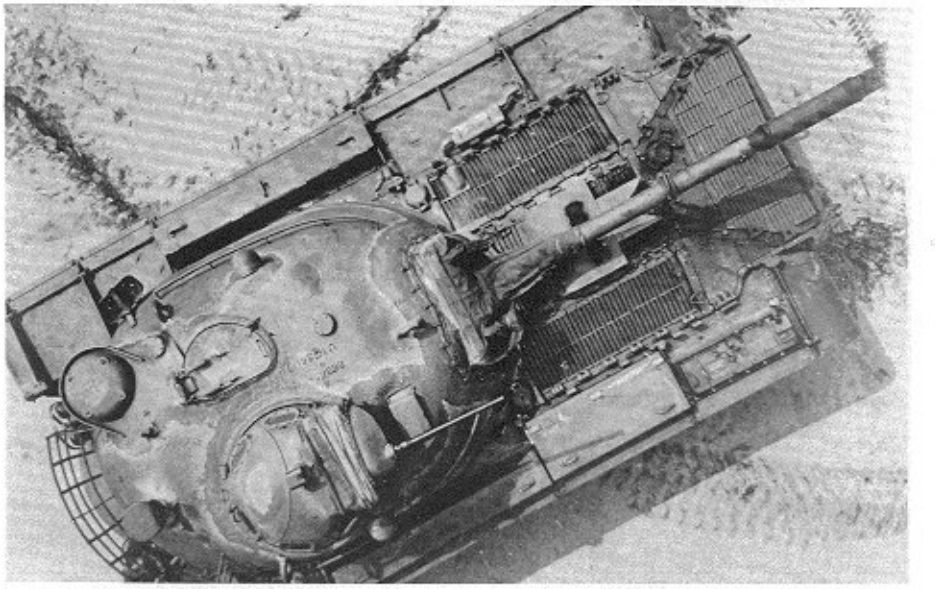
M48A1 Patton

Following the production of some 3000 M48 Pattons those M48s with the large driver's hatch and new .50 caliber commander's cupola turret were designated **M48A1.** Essentially late model M48 Pattons, production was standardized on the M48A1 with these features being the external distinguishing features. Both the M48 and the M48A1 were designated as *standard* types and both were cleared for shipment overseas.

The commander's cupola turret, was in a small enclosed turret from which the tank commander could observe the surrounding terrain using the all-round five vision ports, or fire the .50 caliber gun machine using a periscope sight mounted atop the cupola turret. The cupola turret, designated the M1, was operated by an electro-hydraulic system which elevated, depressed and traversed the turret. While this system allowed a complete traverse of the cupola in fifteen seconds, the hydraulic fluid used in the cupola system created a fire hazard, which was to cause serious problems in combat. The machine gun, mounted on its side due to the limited space inside the cupola, could only accommodate a fifty round magazine; and due to the magazine's size it protruded rather far into the small turret resulting in the firing solenoid often being broken off by the crew as they entered or left the tank and also making it difficult to reload the gun. The cupola also raised the M48A1's height an additional foot. Despite these negative points the cupola turret was effective, and was to remain a feature of the M48 Patton series until its deletion from the M48A5 some twenty years later.

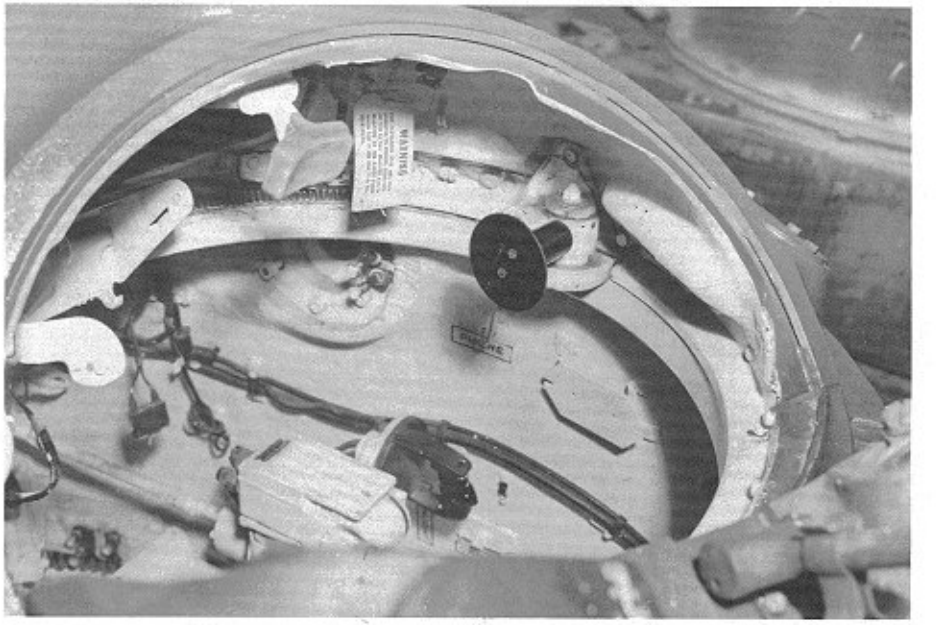
In addition to the cupola turret the M48A1 also standardized on the larger drivers hatch which had been fitted to late model M48s along with the track tension idler wheel. M48A1s also mounted the jettisonable fuel rack. The M48A1 was fitted with the CD-850-4B transmission, a slightly improved version of the type used on the M48. A heavy guage wire basket was added to the rear of the turret.

When the gun barrel was locked in the travel position it had been found that the heat of the engine exhaust froze the lock. An exhaust deflector was installed to redirect the heat away from the gun lock. These heat deflectors were retrofitted to the earlier M48 variants.



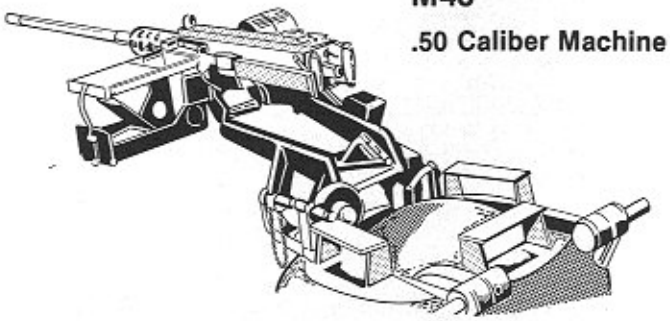
(Above) The main external difference between the M48 and the M48A1 was the M1 commander's cupola turret atop the main turret mounting a .50 caliber machine gun. A heavy gauge wire basket was added to the rear of the turret. (US Army via Binder)

(Below) The interior of the M1 cupola turret was very cramped, severely restricting the commander's movements. This made it difficult to load the machine gun and due to the way it was mounted, the solenoid was often knocked off by the crew when they entered or exited the vehicle. (Rock Island Arsenal via Binder)



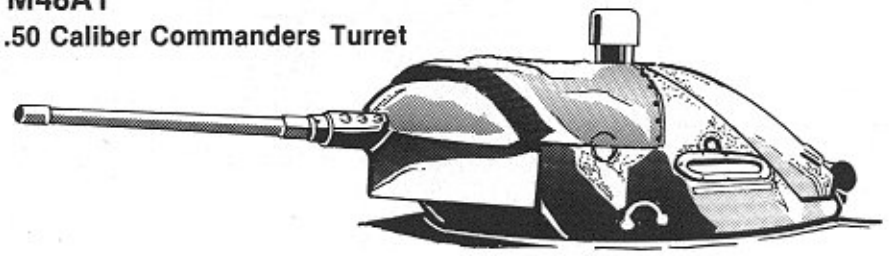
M48

.50 Caliber Machine Gun Mount



M48A1

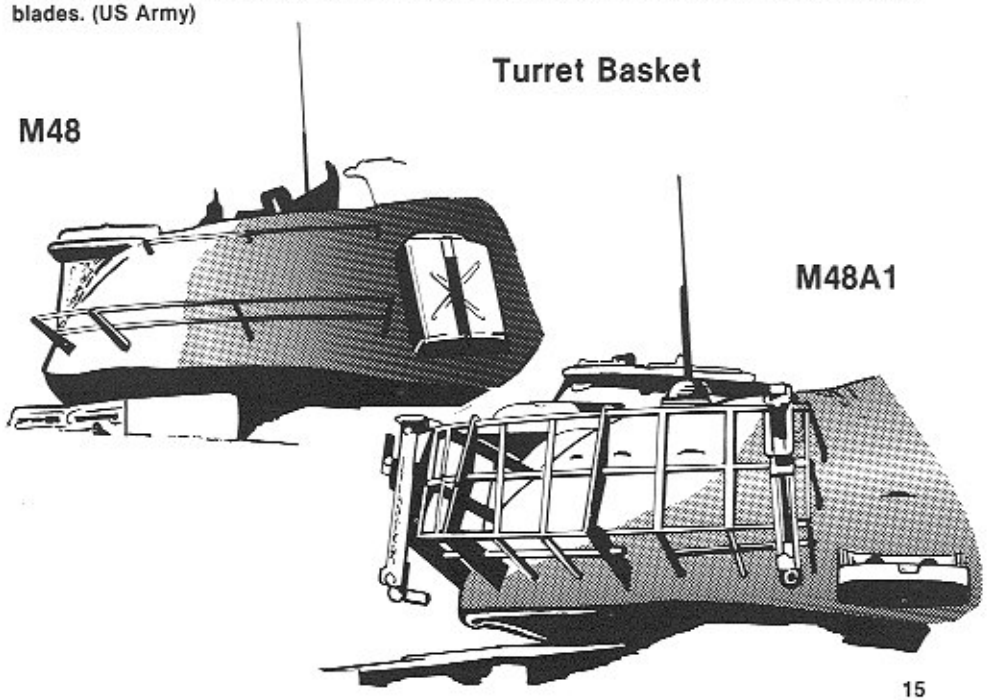
.50 Caliber Commanders Turret



(Above) An M48A1 on the firing range in Germany. The new cupola, track tension idler, auxiliary gas rack, and turret basket can be seen. The rounded fender extensions carried on early Patton variants are seen on the rear fenders but have been removed from the front. (US Army)

(Above) These M48A1s have been fitted with M8 dozer blade kits and searchlights. The two tanks on the left have had their headlights raised for use over the top of the dozer blades. (US Army)

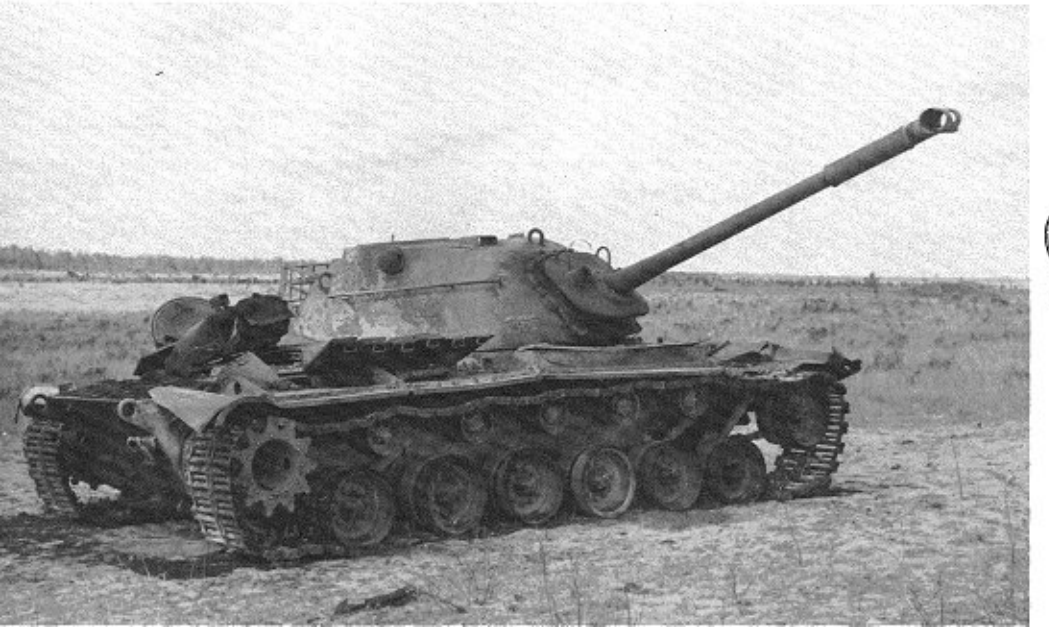
This platoon of M48A1s carry auxiliary fuel drums and have been camouflaged with whitewash while taking part in exercise 'Wintershield II' near Allersberg, Germany in February of 1961. These Pattons are from the 37th Armor, 4th Armored Division. (US Army)

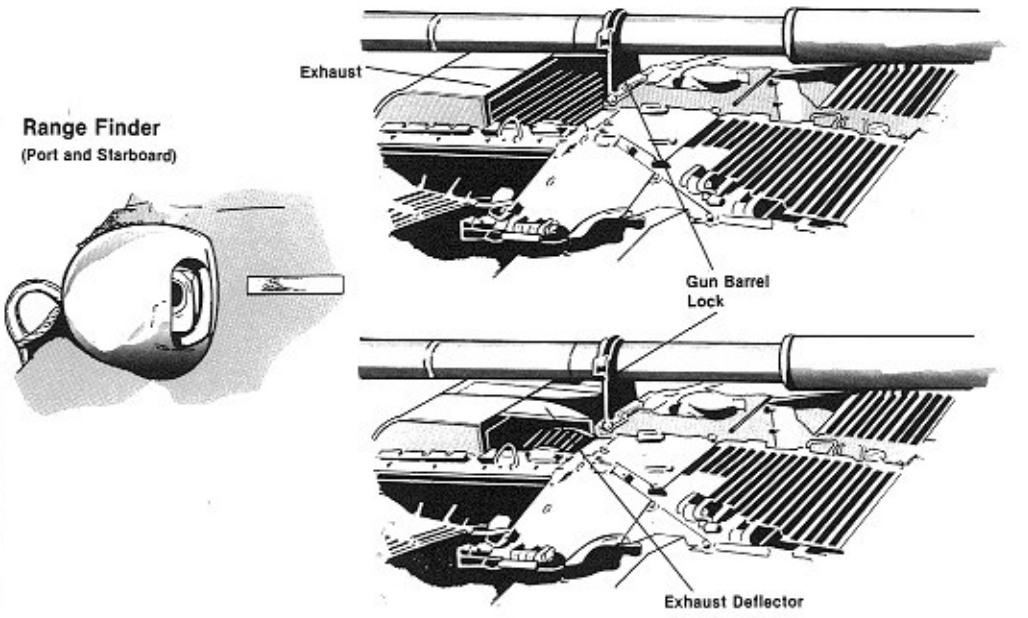


(Above) Many National Guard units received early model Pattons as newer versions became available to the regular Army. Some of these were used during the wave of violence which swept many large American cities during the late 1960s. This M48A1 from the 1st Reconnaissance Battalion, 146th Cavalry, of the Michigan National Guard patrols a street in strife torn Detroit during the summer of 1967. (Michigan National Guard via Binder)

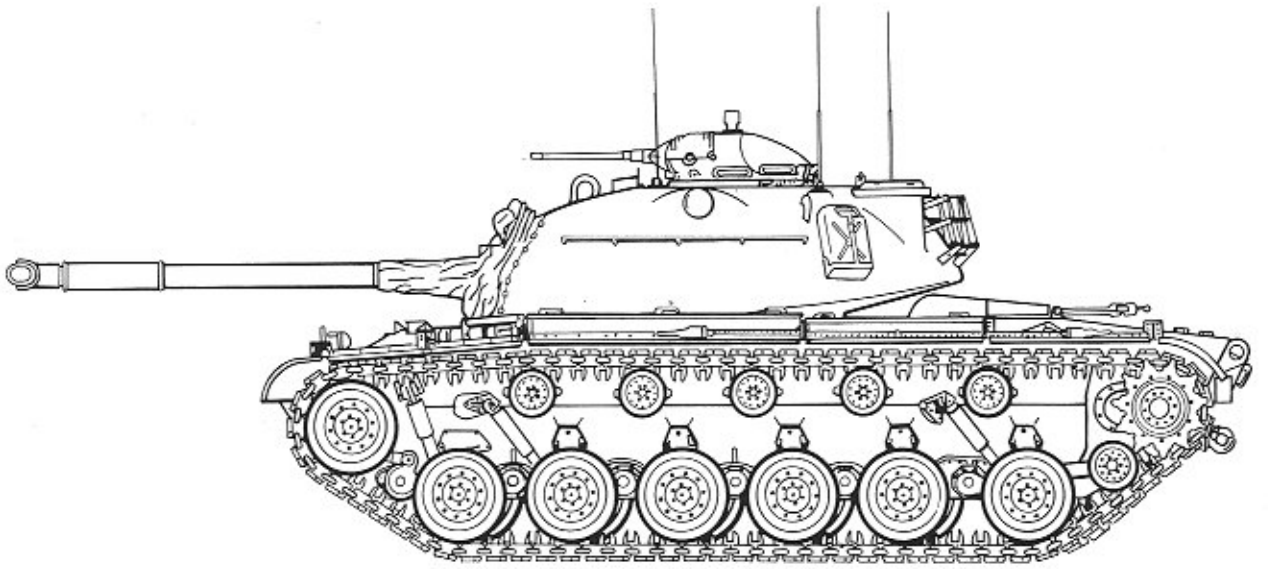
(Above) A number of early Patton chassis were used as test vehicles or targets for new weapons. This M48A1 is being used as a test bed for the Lycoming AGT-1500 turbine engine. The drive sprocket has been lowered and the tension idler eliminated. (Lycoming via Binder)

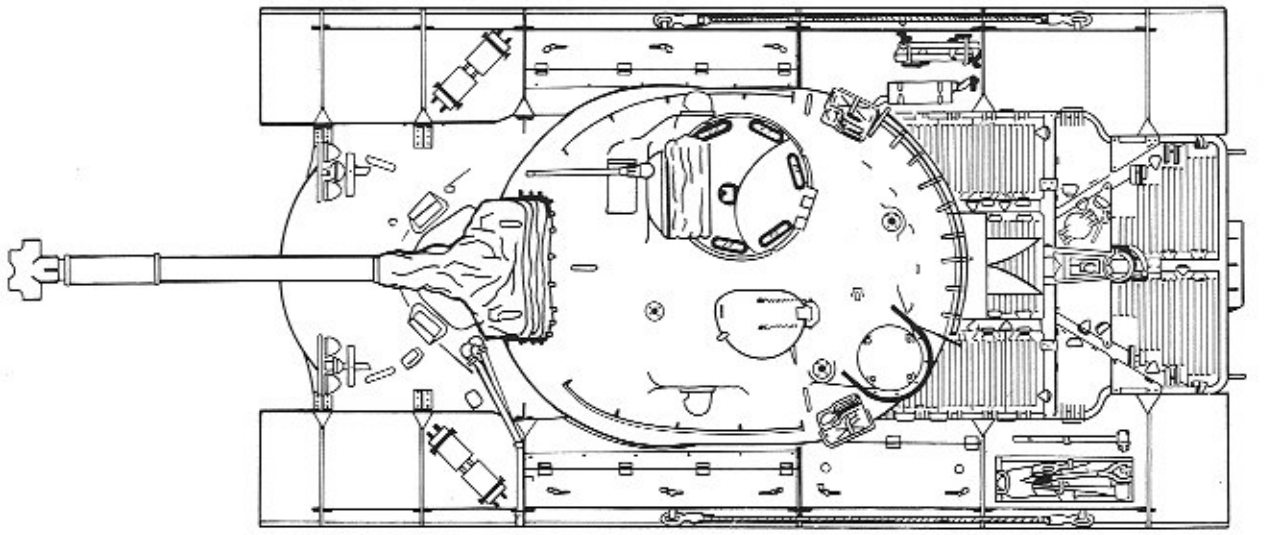
(Below) The results of a hit on an M48A1 by a Maverick missile at Elgin Air Force Base, Florida in 1972. Many early Pattons eventually ended their careers on such ranges. (USAF via Binder)

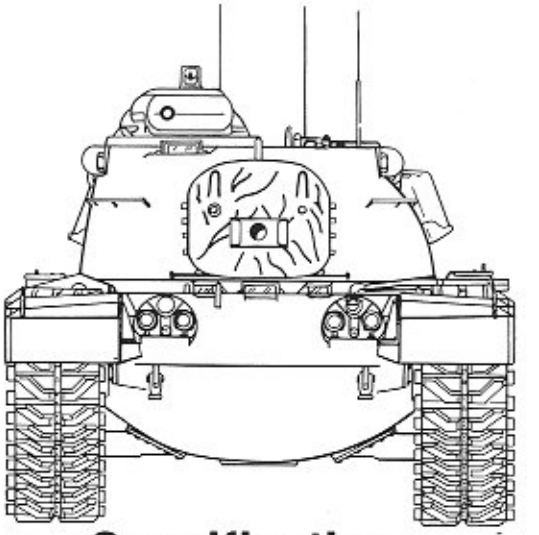




M48A1 90mm Gun Tank



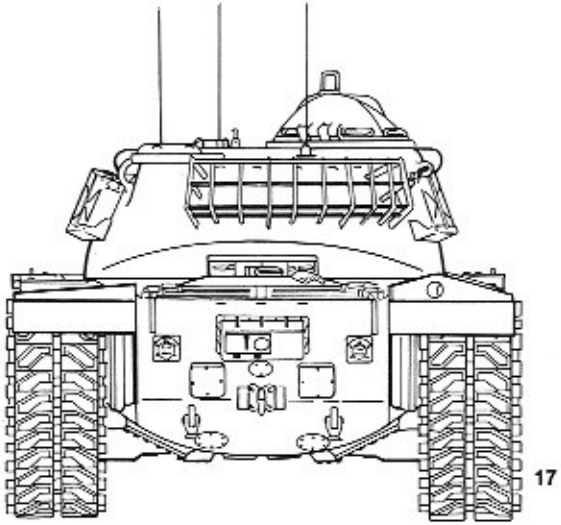




Specifications

90MM Gun Tank M48A1

Crew	4 Men
Length (Gun Forward)	346.9 Inches
Width	143.0 Inches
Height (Cupola)	121.6 Inches
Ground Clearance	16.5 Inches
Combat Weight	104,000 LBS
Armament	
Main	90MM Gun
Secondary	
Cupola	.50 Caliber
Co-Axial	.30 Caliber
Engine	AV-1790-5C
Horsepower	690 HP
Maximum Speed	28 MPH
Range	70 Miles
With Jettisonable Fuel Tanks	135 Miles



M48A2/M48A2C

One of the most serious shortcomings of the M48 and M48A1 was the short range, of only some 70 miles. Most of the deficiencies caused by pressing the Patton into early production were eventually overcome through modification or redesign, but the vehicles poor combat radius could not be so easily solved. The jettisonable rack for four 55 gallon fuel drums was a stopgap measure, and one that could be extremely hazardous. What was needed was a complete redesigning of the engine and fuel system. Additionally, the rear engine deck gave off a great deal of heat which resulted in a significant infra-red signature, even to the primitive detectors in use at the time.

T48E2

As a result of these problems the Army decided to change the engine and deck arrangement in an effort to increase the overall effectiveness of the M48. The Detroit Tank Arsenal undertook studies to install both a new transmission and a new engine. Three M48s served as test beds for the modifications. Under the designation M48E1 a crash program was begun in October of 1953 to install the new Continental AVI-1970-8 engine and a XT-1400 transmission. The first test vehicle was completed in late November and shipped to Fort Knox for evaluation. Installation of the XT-1400 transmission had required a redesigning of the lower rear hull and a reduction in ground clearance and consequent decrease in cross country mobility. This decrease in ground clearance was unacceptable to the Army and the XT-1400 transmission was dropped. Under the designation T48A3 the AVI-1970-8 engine was teamed with the updated CD-850-4B transmission. As the AVI designation indicated, the two carburetors were replaced with a Simonds SU fuel injection system that allowed the oil coolers to be mounted on the top of the engine itself, eliminating the large outrigger oil cooling fans. This increase in space allowed internal fuel capacity to be increased from 200 gallons to 380 gallons.

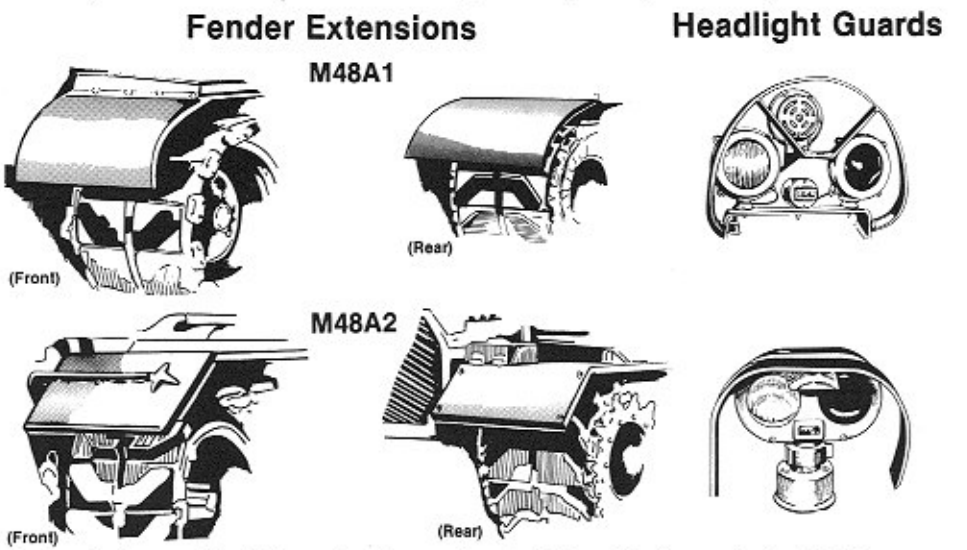
Re-designated M48A2, the new variant went into production in 1955, the new fuel injection system provided only slightly greater fuel economy than the previous drive train, but the additional internal fuel capacity more than doubled the M48A2's range over previous M48s. Outwardly, the rear of the M48A2 was completely redesigned. A new raised rear deck which allowed for better cooling was added. Much of the grill work on the upper surface of the top of the rear deck was eliminated which cut down significantly on the tanks infra-red signature. Exhaust gases were directed out two large louvered doors on the rear. These louvered doors replaced the slanted armored rear of the M48A1 and in combination with the revised rear deck gave the rear of the M48A2 a box-like appearance. This box like engine compartment shape was to remain essentially unchanged through the remaining M48 models and would eventually be carried over into the later M60 series.

Various modifications made to the M48 and M48A1 were incorporated into the T48A2. In October of 1955 the T48A2 was ordered into production under the designation M48A2. After having gone through an extensive testing program, when this model rolled out of the factory, it was the first variant of the M48 which did not experience serious problems in the field. The round fender extensions were replaced by square extensions and a more squared headlight guard replaced earlier rounded guard on both the Marine and Army M48A2s. Besides the completely redesigned rear deck another significant external difference between the earlier M48A1 model was the reduction of return rollers from five per side to three per side to save weight on Army vehicles. Those M48A2s ordered by the Marine Corps retained the full five return rollers.

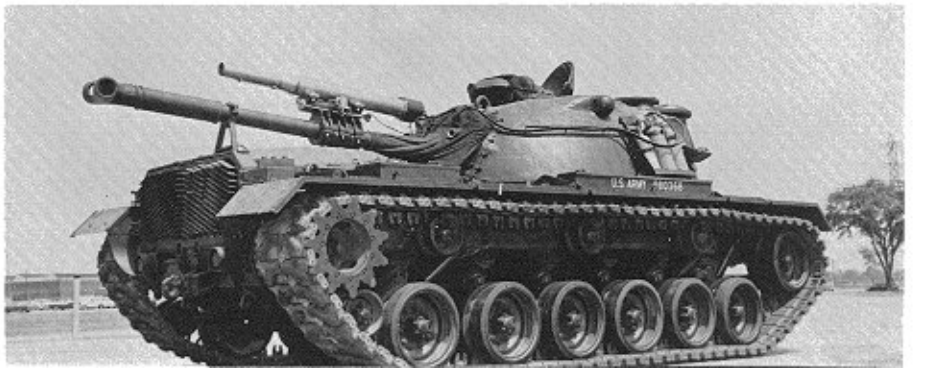
M48A2C

During production, the M17C coincidence rangefinder was substituted for the troublesome M13A1 stereoscopic rangefinder. This change in the rangefinder, along with other minor changes in the fire control layout resulted in a sub-variant of the M48A2 under the designation M48A2C. The only recognizable feature which differentiated between this version and the M48A2 was the absence of the tension idler wheel between the last road wheel and the drive sprocket. Production of these two variants of the M48 Patton did not end until 1959, with more M48A2s and M48A2Cs being produced than any other M48 variant. Many of these were exported to foreign countries.

This new M48A2 is being demonstrated to troops at Fort Benning shortly after the introduction of the new model into the Army inventory. The main external differences between this model and the earlier M48 and M48A1 are the squared fender extensions, raised engine deck, vertical rear hull, and only three return rollers. Marine Corps M48A2s, however, retained the five return roller configuration. (US Army via Binder)



Due to the improved fuel injected engine and greater internal fuel capacity the M48A2 was the first M48 variant to have a good radius of action. Installation of the Continental AVI-1970-8 required the engine compartment deck to be raised and the rear of the engine compartment to be squared off with exhaust louvers. The device on the gun barrel and turret of this vehicle is an M4A1 Gunfire Simulator produced by FMC Corporation. (FMC via Binder)

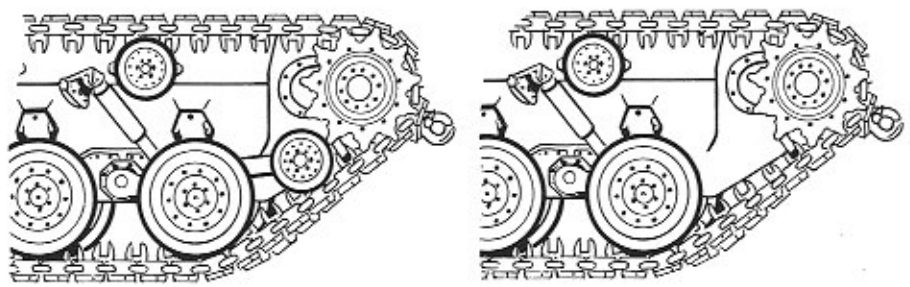


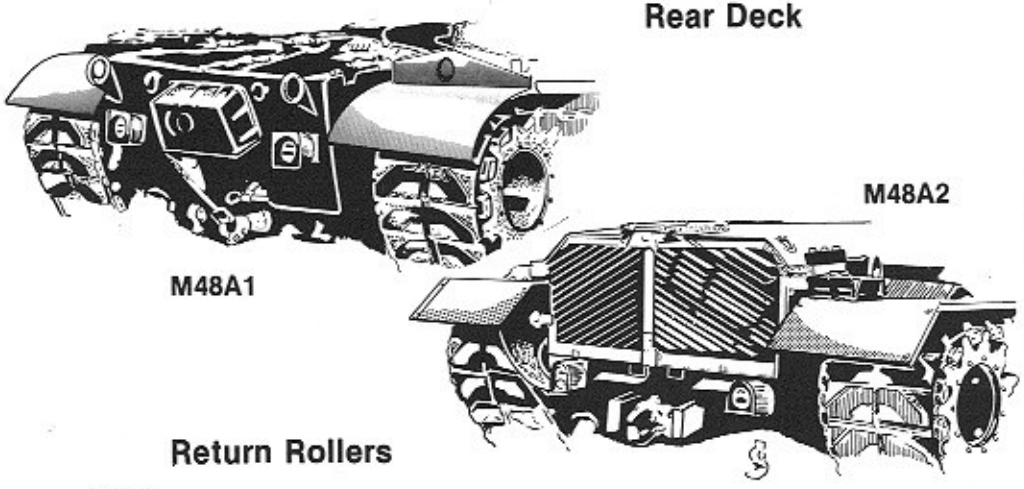
Due to its marked improvement over earlier Patton variants the M48A2 was quickly incorporated into the US armored forces. This M48A2C is seen taking part in exercise 'Long Thrust II' in Germany during early 1962. The lack of a tension idler between the last bogey wheel and drive sprocket indicates that this is an M48A2C.

This platoon of M48A2Cs from the 2nd Battalion, 72nd Armor, 2nd Infantry Division take part in an operational readiness test near the Korean DMZ. Only two of the tanks are equipped with searchlights; armored units in Europe and Vietnam had priority over other formations in upgrading their equipment. (US Army via Binder)

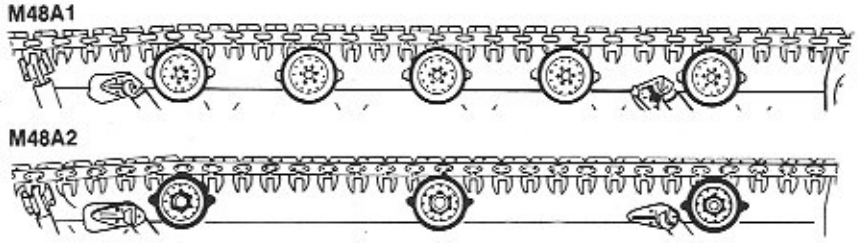
M48A2GA2

Germany, one of the largest recipients of the M48A2 model, updated over 600 of their Pattons by replacing the 90MM cannon with a 105MM gun. This version, designated the M48A2GA2, was easily recognized by the absence of a muzzle brake, the addition of a fume extractor on the barrel, a new gun mantle, and the replacement of the M1 cupola turret with a lower profile German produced cupola turret. These up-gunned Pattons were issued mainly to reserve type units until the newer version of the Leopard could be produced in sufficient numbers.

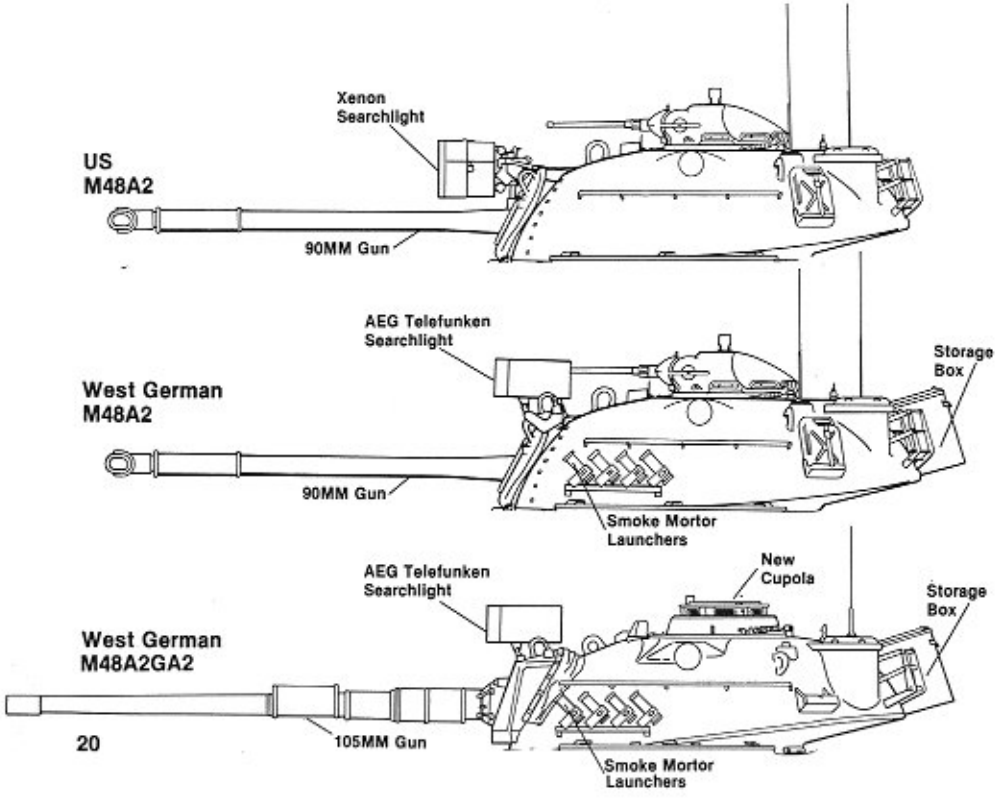




One of the largest recipients of the M48A2 series was the West German Army. They made a number of modifications to the Patton which included the addition of smoke mortar launchers on the turret and the use of an AEG Telefunken searchlight. The device on the barrel is a pyrotechnic simulator used in training. (US Army)



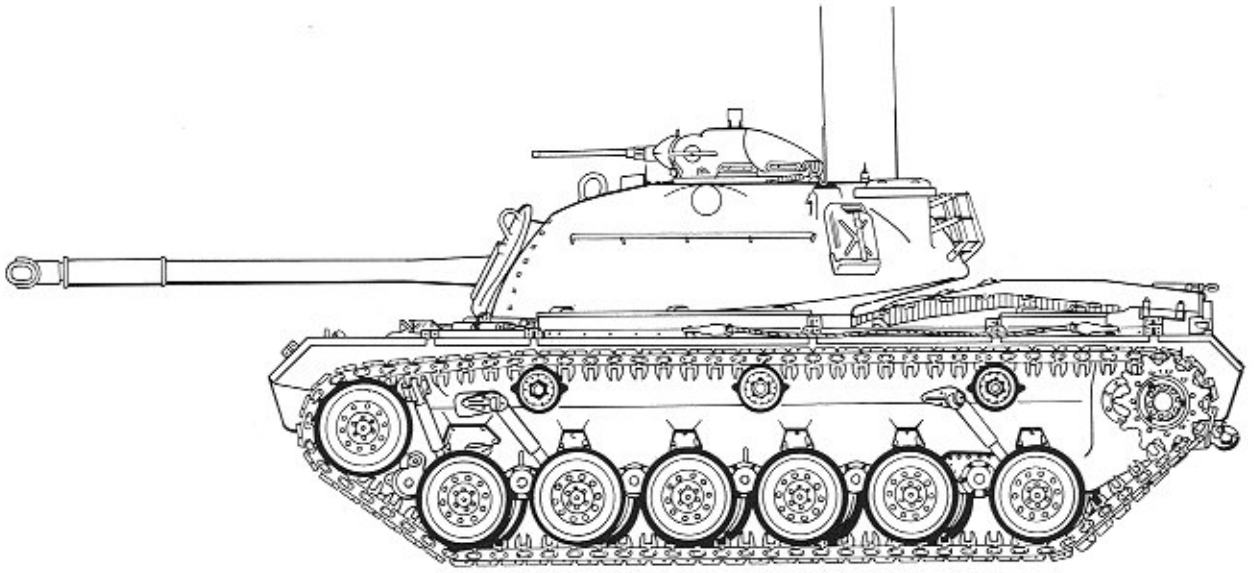
Another modification made to their M48A2Cs by the Germans was the addition of a large storage box on the back of the turret. This box was similar to the one later mounted on the Leopard. (US Army)

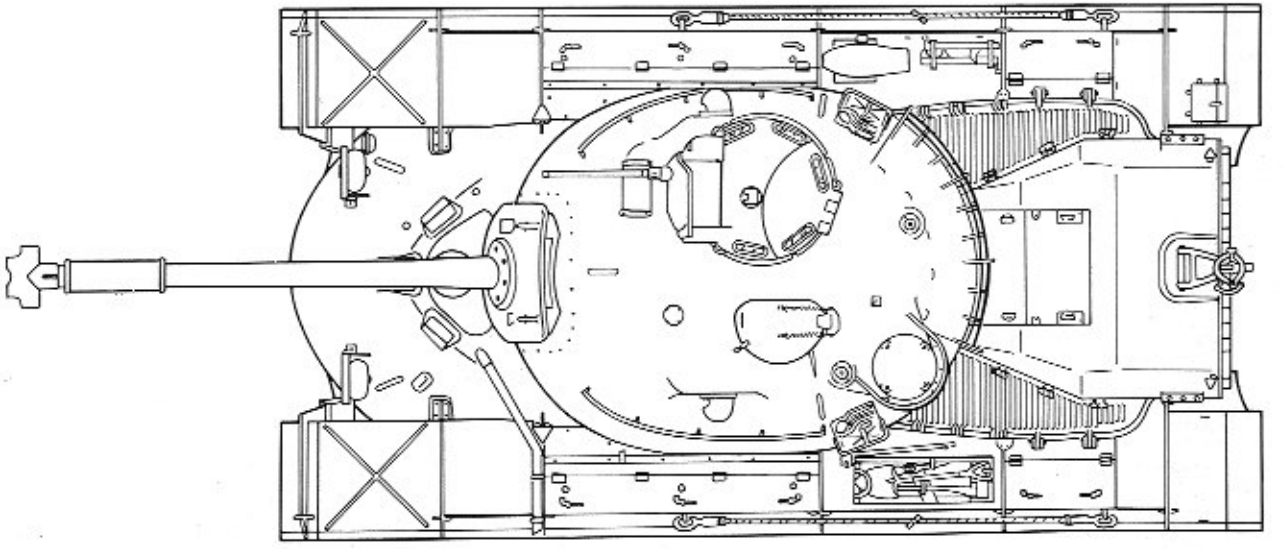


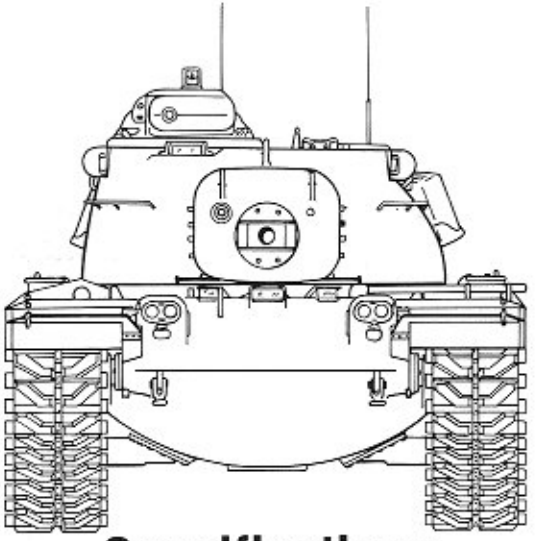
In the late 1970s the Germans decided to upgrade some of their M48A2s with a 105MM gun. This modification was done by Wegmann Industries of Kassel and involved a completely new mantle for the gun and the replacement of the M1 commander's turret with a hatch type of cupola. The West German 105MM modified Patton was designated the M48A2GA2. (Wegmann via Tillotson/Foss/Binder)

Most of the M48A2GA2s were distributed to the West German equivalents of the US reserve or national guard units. Eventually these up-gunned Pattons will be withdrawn from service and replaced with the newer Leopard tank. The new gun mantle is much more square than the 90MM gun mantle and is easily recognized as is the 105MM gun barrel. Note also the addition of rear view mirrors and the square headlight guards which were typical of German Pattons. (Green)

M48A2C 90mm Gun Tank



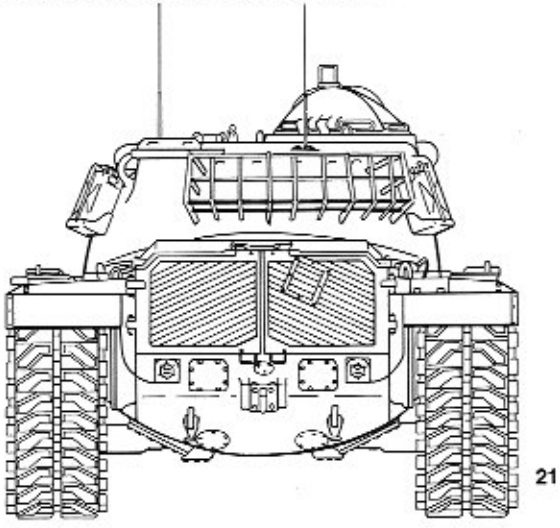




Specifications

90MM Gun Tank M48A2C

Crew	4 Men
Length (Gun Forward)	341.8 Inches
Width	143.0 Inches
Height (Cupola)	121.6 Inches
Ground Clearance	16.5 Inches
Combat Weight	105,000 LBS
Armament	
Main	90MM Gun
Secondary	
Cupola	.50 Caliber
Co-Axial	.30 Caliber
Engine	AVI-1790-8
Horsepower	690 HP
Maximum Speed	30 MPH
Range	160 Miles
With Jettisonable Fuel Tanks	250 Miles



M48A3

During the mid-1950s intelligence reports indicated that the new Russian tank main battle tank, the T-54, with its 100MM gun and thick armor, posed a serious threat to allied armor. This caused a great deal of concern within the Army, and resulted in a program to totally upgrade the main battle tank design. This complete design upgrade which resulted in the M60, was somewhat similar in appearance to the M48 Patton, but was armed with a 105MM gun, a different cupola turret, and the new AVDS-1790-2 diesel engine. The switch to a diesel engine by the Army was due to a desire to increase fuel economy, standardize on one type of vehicular fuel and reduce potential fire hazard. Procurement of this new model began in 1959 which effectively ended production of the M48. But while the introduction of the M60 ended production of the M48 Patton it by no means ended development of the M48.

Since the new M60 offered significant advantages over the older M48 in terms of fuel efficiency and reduced fire hazard, the army decided to conduct a feasibility study to retrofit components of the M60 in order to modernize the older, and still somewhat troublesome M48A1. The first of six authorized pilot models of the test study was delivered to Aberdeen Proving Grounds in March of 1960, and was officially designated the M48A1E1 the following month. Power trained by an AVDS-1790-2 diesel engine coupled to the Allison CD-850-6 transmission of the M60, the M48A1E1 engine compartment and rear deck was modified to M48A2 standards which provided ample room for the diesel engine and M60 type aluminum fuel tanks. The turret was modified to accept the 105MM M68 cannon, with the coaxial .30 caliber machine gun being replaced by a 7.62MM machine gun. The .50 in the commander's cupola remained unchanged. The M60 fire control system was installed, which included the coincidence range finder, an articulated telescope, and a modified ballistic computer. While the suspension system was basically unchanged it was upgraded with the new compensating idler, track adjusting link, double bump springs, and the track tension idler was removed. The test program concluded that not only was the upgrading of the M48A1 feasible, but the M48A1E1 was very nearly comparable to the M60, and superior to all previous variants of the M48.

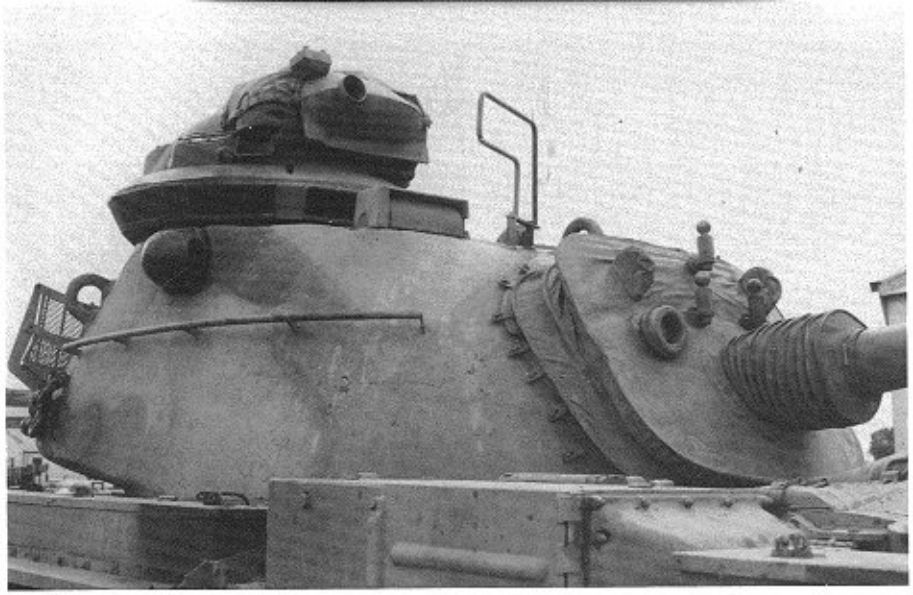
M48A3

It was decided to modernize some 600 M48A1s at Army Ordnance Centers, but because of the large stocks of 90MM ammunition, and cost considerations, it was decided to retain the 90MM gun. Two of the test vehicles were refitted with the 90MM under the designation M48A1E2, and served as engineering test vehicles for the modernized M48A1 under the designation M48A3. Conversion work began at the Anniston and Red River Army Depots with deliveries beginning in February of 1963, eventually providing 600 M48A3s to the Army and 419 to the Marine Corps. Powered with an AVDS-1790-2A engine and a CD-850-6A transmission, the M48A3 could be distinguished from the M48A2 by the addition of air filter boxes carried on the mudguards and the reappearance of the two return rollers which had been deleted on the M48A2.

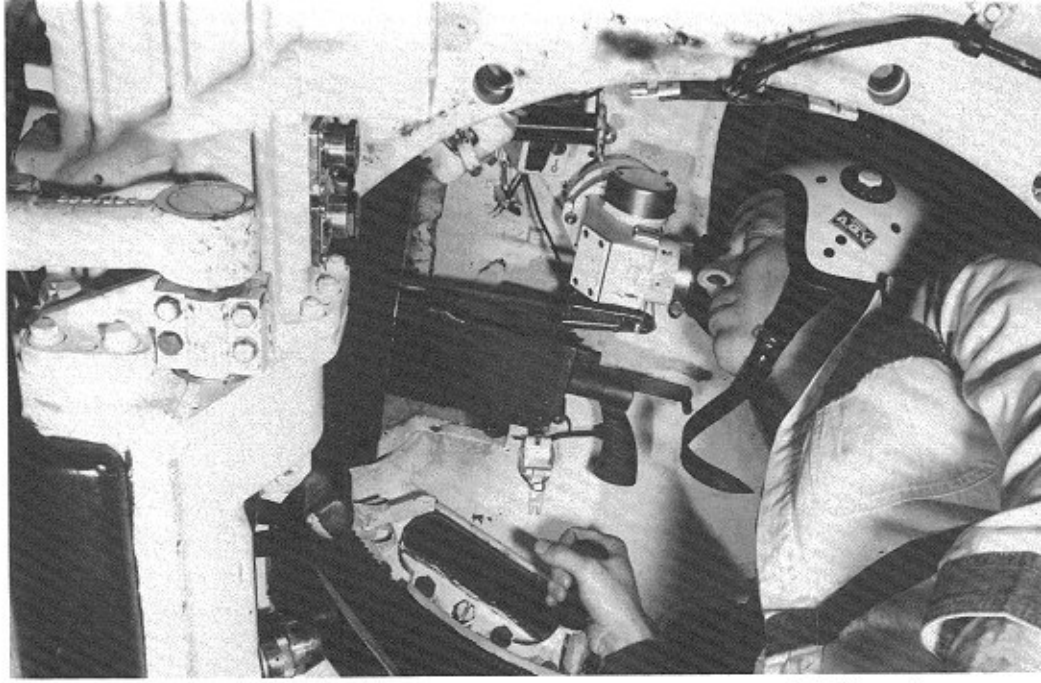
The larger fuel tank added to the engine compartment, which, when coupled with the more fuel efficient diesel engine, resulted in a range of almost 300 miles for this new model. During the conversion process, a number of improvements were incorporated in the M48A3 design based on field experience, particularly that which came from Vietnam. These included new brakes, improved driver control linkage, a new inflatable turret seal and the addition of screening to the turret stowage rack. In addition some vehicles, including the last conversion batch, received a G-305 turret cupola riser which gave the tank commander a better all around visibility. As mentioned earlier, the one M60 modification which was not incorporated into the M48A3 variant was the addition of the 105MM gun in place of the old 90MM cannon. Such a modification was, however carried out by the Israeli Army on their M48s with excellent results, but despite the success of the Israelis, the US Army showed no interest in this conversion until unforeseen problems in the M60 program necessitated a serious reconsideration of this position.

Updating the M48A1 with as many M60 component parts as possible produced the M48A3 variant of the Patton and produced a tank that was as nearly as good as the M60 and significantly superior to previous M48 variants. Installation of the diesel engine not only provided better performance and increased the tank's range to almost 300 miles, but also reduced the risk of fire associated with the older gasoline engined models. (Tank Automotive Command via Binder)

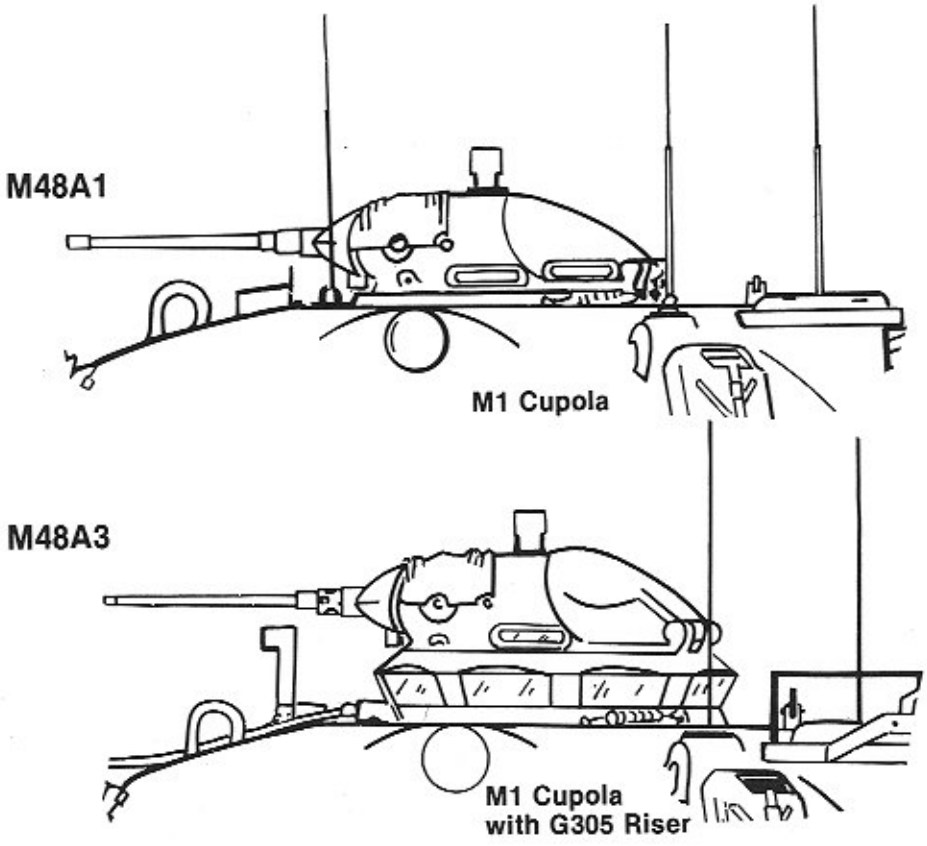
The engine compartment of the diesel powered M48A3 was identical to that of the gasoline powered M48A2. One of the main external differences between the M48A3 and the M48A2 was the addition of box shaped air filters located on the rear fenders. These new air filters were initially of the side loading type, but were later replaced by a new design which opened upward. (Binder)



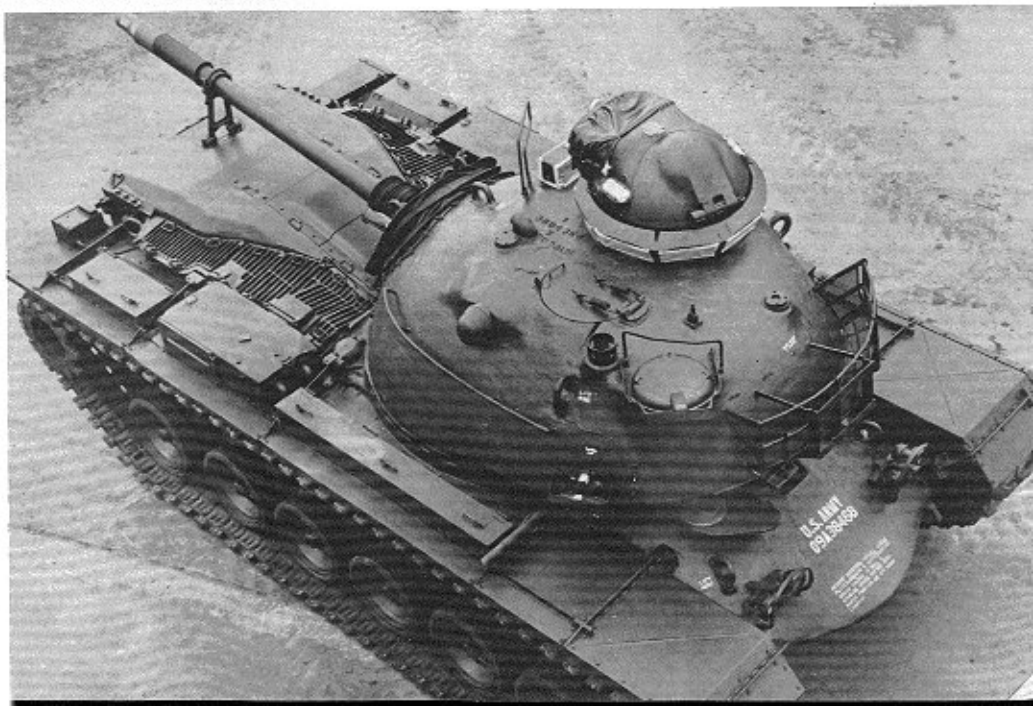
The G305 turret riser provided excellent all-around vision. The heavy gauge turret interrupting bar which restricts where the cupola gun can fire can be seen mounted just in front of the turret. Mounting brackets on the mantle are for the searchlight. (Binder)



Even with the addition of a turret riser the commander's turret was still crowded, although visibility was increased. The .50 caliber turret is being traversed by the tank commander as he looks through the periscope. (US Army via Binder)



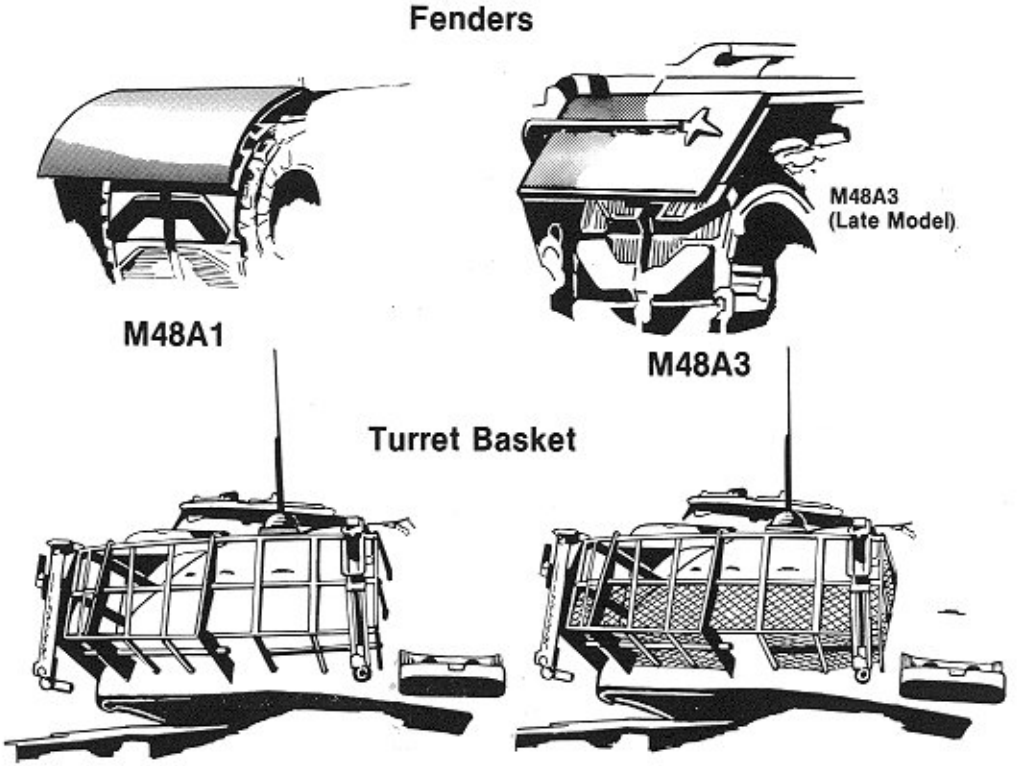
Eventually the G305 riser was selected and standardized on later batches of M48A3s. The M48A3s were often referred to as the M48A3 (Late Model). The M48A3 (Late Model) Pattons had additional minor internal changes and wire screening was added to the turret storage basket. (Binder)



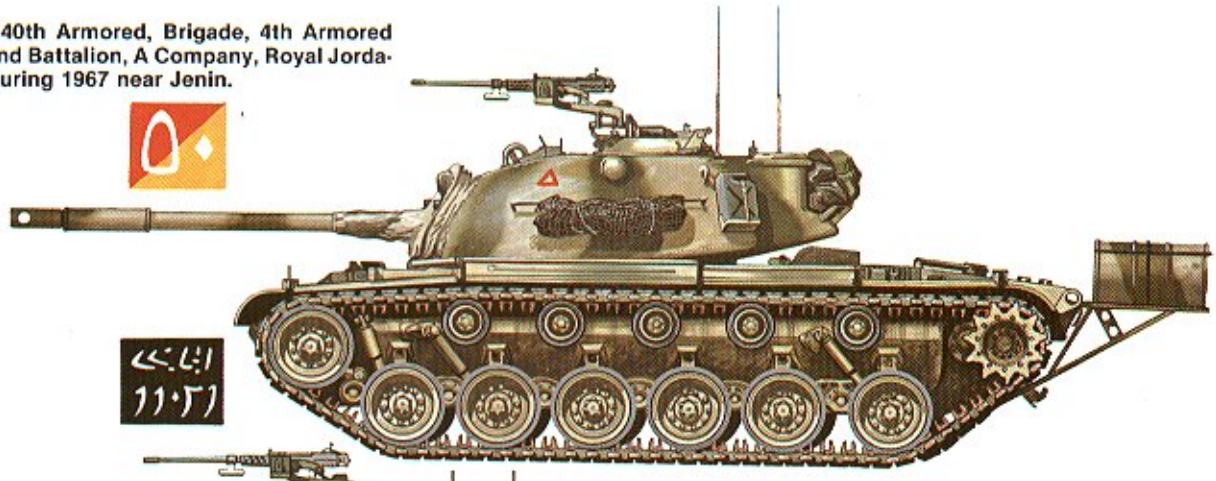
(Above) The M48A3 retained the five return roller configuration of the M48A1. This late model Marine Corps M48A3 is seen during an amphibious landing exercise. The exhaust extension at the rear of the engine deck allows the tank to come ashore in deep water. (USMC via Binder)

(Below) M48A3 remained the main battle tank of Marine Corps tank battalions into the early 1980s. These Marine Pattons patrol a road near the perimeter of the Guantanamo Bay Naval Base in Cuba. These late model M48A3s have the new reinforced fenders which were added to late production A3s.

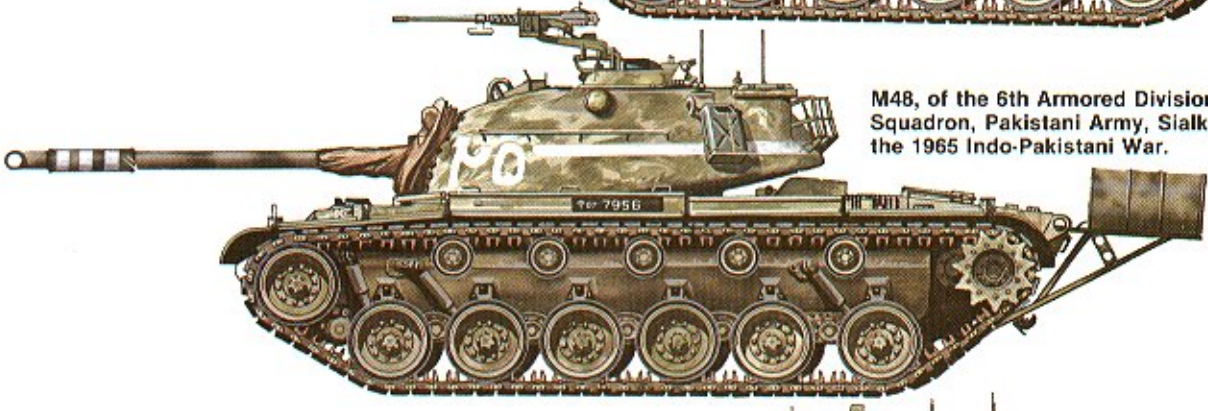
The emergence of the new M60 series meant that the M48A3 was assigned to Army armored units in less critical zones of the world. Many were used in Vietnam, Korea, and for training in the US while the M60 series was assigned to the European theater, facing the newest Soviet armor. This M48A3 Patton of the 1st Armored Division takes part in an exercise at Fort Hood as part of the aggressor force during the early 1960s. (Continental Teledyne via Binder)



M48 of the 40th Armored, Brigade, 4th Armored Regiment, 2nd Battalion, A Company, Royal Jordanian Army during 1967 near Jenin.

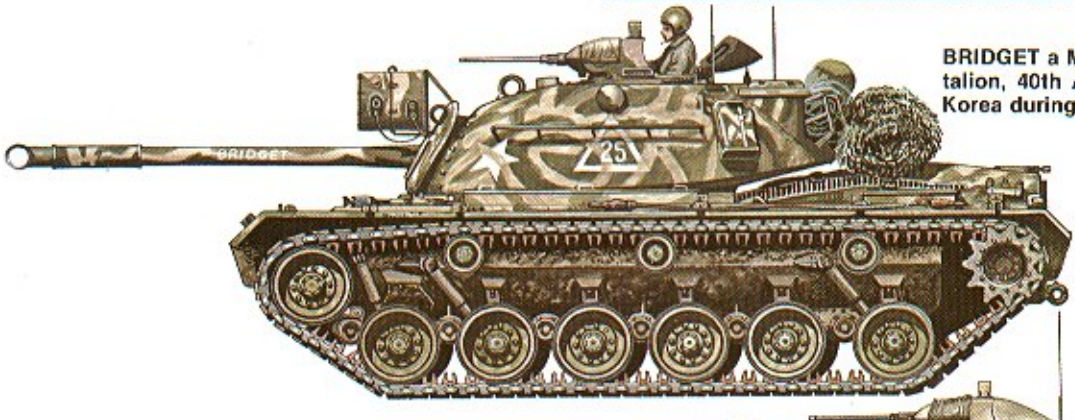


M48, of the 6th Armored Division, 25th Cavalry, C Squadron, Pakistani Army, Sialkot Sector, during the 1965 Indo-Pakistani War.



M48A1, of Company A, 37th Armored, US 4th Armored Division, Neukircheu, Germany, during exercise Wintershield II in February of 1961.

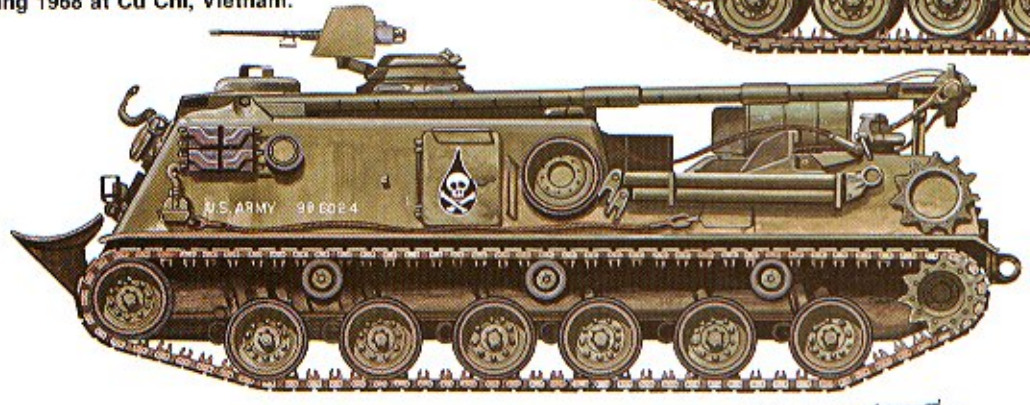
BRIDGET a M48A2C of Company A, 3rd Tank Battalion, 40th Armored, US 1st Cavalry Division in Korea during 1962.



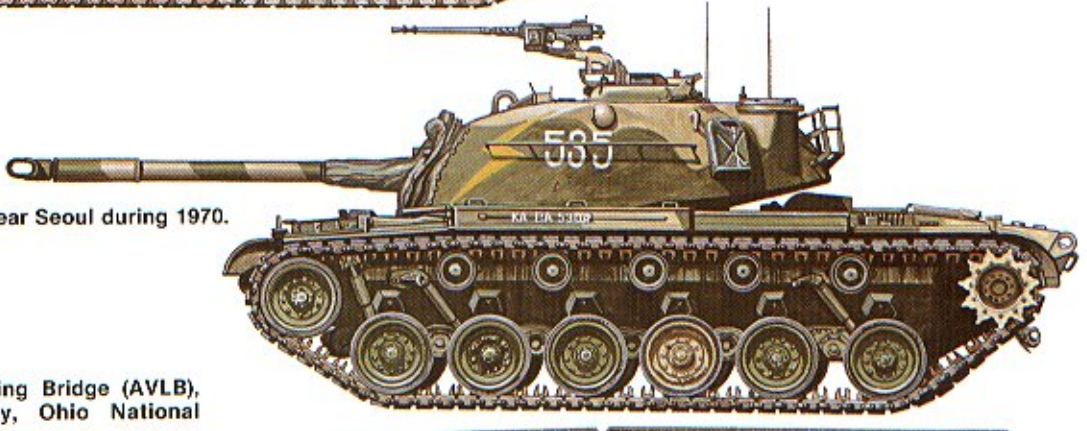
Israeli M48A2C, Ugdo Tal, 7th Armored Brigade, 79th Tank Battalion, in the Sinai during 1967.

M48A2C, Federal Republic of Germany, 35th Brigade, 12th Panzer Division, as part of the aggressor 'Orange Force', during exercise 'Certain Thrust', in conjunction with 'Reforger II' during the Fall of 1970.

American M48A3, 3th Calvary, supporting the 25th Infantry Division in Vietnam during the Summer of 1968.

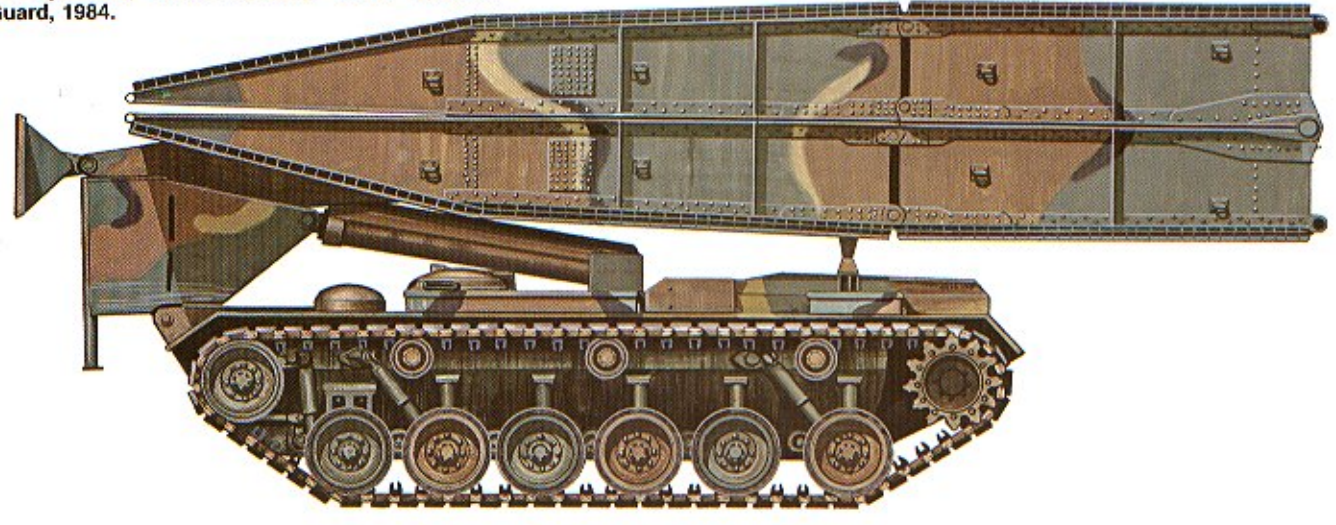


M88 Armored Recovery Vehicle, of the 65th Engineering Battalion, 25th Infantry Division, during 1968 at Cu Chi, Vietnam.



South Korean M48 near Seoul during 1970.

M48A2 Armored Vehicle Laying Bridge (AVLB), Headquarters, 107th Cavalry, Ohio National Guard, 1984.



M67 Flamethrower Tank

During World War Two, a number of the combatants mounted flamethrowers in armored vehicles for use in assaults on fortified positions. In particular, the United States used M4 Shermans mounting flamethrowers extensively during the later stages of the Pacific War against deeply dug-in Japanese bunkers. These flamethrower tanks proved to be invaluable in rooting out the fanatical Japanese defenders and helped reduce American casualties during the US island hopping drive across the Pacific. Following the end of World War II interest in flamethrower tanks waned, but during the Korean War flamethrower Shermans were again used to burn out dug-in North Korean and Chinese positions.

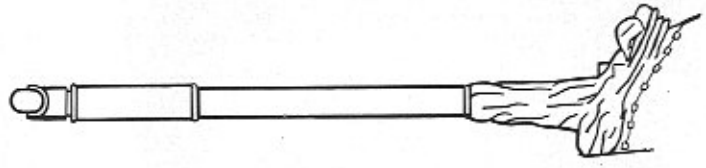
The usefulness of flamethrower equipped tanks during the fighting in Korea prompted the Army to begin conducting experiments with flamethrower tanks. A number of vehicles were tested in this role, including the M47 Patton tank, but none were put into production. With the decision to re-equip the armored forces with the new M48 Patton, the Army opted instead to use this vehicle in the flamethrower role so as to standardize its equipment on one basic chassis and make it difficult for an enemy to pick out the flamethrower tank from regular M48s. Initially, development of this flamethrower M48 variant was given the designation T67. It mounted an E30R1 flame gun and E28 fuel and pressure system which had been originally fitted into the earlier experimental M47 flame tank. The M6 flamethrower gun, although somewhat shorter and slightly larger in diameter, was designed to reassemble the 90MM cannon, and was mounted in a T7 flamethrower turret along with the system's 378 gallon fuel tank and a ten cubic foot air tank pressurized at 3000 PSI. The flame tube had holes in the side to allow the entrance of air, and a removable cover on top of the barrel to allow access to the ignition components. The tank could fire a continuous stream of flame for approximately one minute, although normally bursts of only a few seconds duration were used in actual practice. While a theoretical range of 150 to 200 yards was possible, accuracy dropped off after 100 yards, and this could be reduced even further by weather conditions, visibility, or terrain features. In addition the crew could alter the range by nozzle setting, elevation, and fuel thickness. The gunner aimed and fired both the flamethrower and the coaxial .30 caliber machine gun, and since no cannon was mounted the gun loader was deleted from the crew, reducing it to three. After extensive testing the flamethrower unit was adopted and renumbered the M7-6. Mounted in a M48A1 chassis, the T67 Flame Tank was redesignated the M67 Flame Tank. Including the pilot T67 which was brought up to M48A1 standards, 74 M67s were produced. Other than the tube, the only other external changes were a slightly different shaped blast defector and a flattening of the headlight guards to allow for more depression of the flame tube.

Production of the M67 started in 1955, but with the introduction of the M48A2, production was switched to this chassis, under the designation M67A1. This version mounted the slightly modified M7A1-6 flamethrower in place of the original unit and the newer XM30 periscope for improved fire control capability. Subsequently when the M48A2 was upgraded to the M48A3, the same was done to the M67A1 which was designated the M67A2.

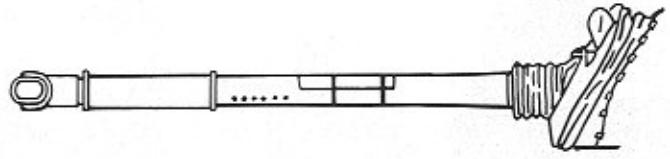
The M67 Flamethrower Tank never achieved widespread use. It was operated in limited numbers by the Army (M67A1) and Marines (M67, M67A2). None were exported for foreign use and even the US Army quickly deleted this version from its inventory after a relatively short service life. The Marines however, issued nine tanks to the Flame Platoon of the Headquarter and Service Company of their tank battalions. In 1965 when the Marines were committed to Vietnam, two tank battalions, the 1st and 3rd, were deployed with their M67A2s. Though occasionally used in offensive sweeps, the flame tanks could not carry enough fuel for sustained operations in the field, which proved to be a very real disadvantage. More often than not, the M67s, nicknamed *Zippos* or *Flames*, were confined to base camps where they were used to bolster defenses, clear away perimeter vegetation, or burn garbage. During the Tet Offensive in February of 1968, two M67s and M48s were the only Marine armor in Hue for almost two weeks until a platoon of M48s managed to break through communist lines and relieve them. However, when the Marines were withdrawn from Vietnam, they slowly began to phase the M67 Flamethrower tank out of their table of organization. Many if not all of these are now in storage at Barstow, California in case they are needed in the future.

The shorter, stubbier appearance of the gun barrel is the main feature which distinguishes the M67 Flame Tank from the standard M48. This particular vehicle is an M67A1 based on the chassis of the M48A1. Markings are in yellow and the nickname, 'The Dragon', can be seen on the side of the turret under the machine gun cupola. (Chrysler via Binder)

M41 90MM Gun

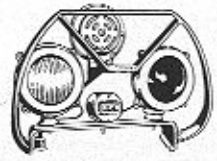


M7-6 Flame Gun



Headlight Guard

M48A1



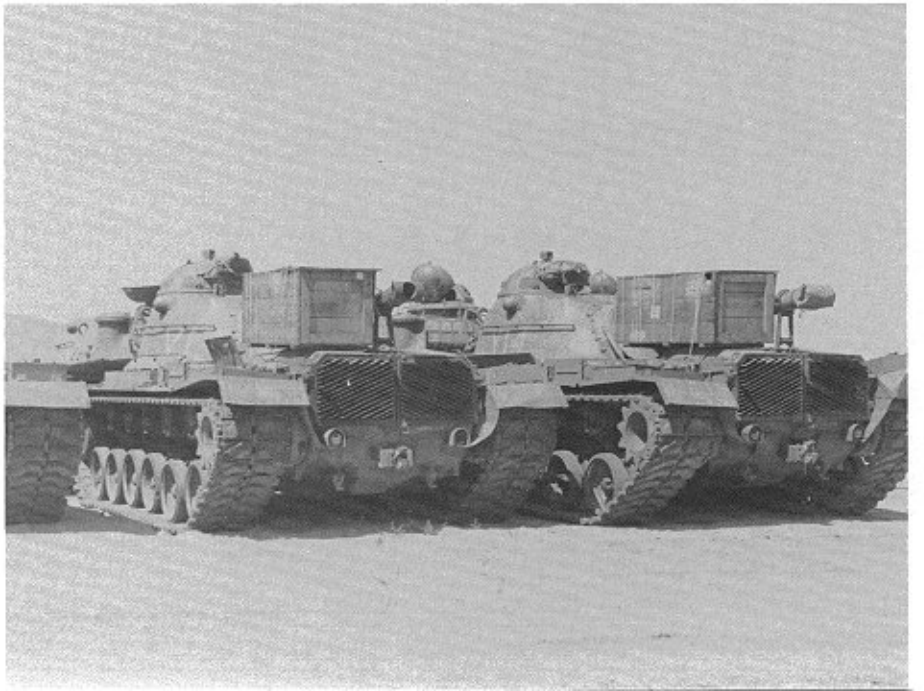
M67A1

The Army only operated one variant of the flamethrower Patton, the M67A1, and only for a limited time. This M67A1 gives a demonstration of its firepower to a group of cadets at Fort Knox in June of 1961. Due to the elimination of the 90MM cannon, the loader was no longer needed, reducing the M67's crew to three. (US Army via Binder)

An M67A1 from the 2nd Armored Division demonstrates its firepower during OPERATION BIG LIFT. Theoretically the range of the flamethrower was between 150 and 200 yards, but beyond 100 yards accuracy dropped off sharply and this could be reduced even further by weather conditions, terrain features, and visibility. (US Army via Binder)

Only the Marines used their M67 Flamethrower Tanks in action during the conflict in Vietnam. However, the limited fuel capacity of the flamethrower tank restricted its operational usefulness, and rarely was the tank used for extended ground sweeps. This M67A2, of the 1st Tank Battalion, fires on an enemy positions during OPERATION DOZER in Quang Ngai Province. A wading breather is carried on the side of the turret. (USMC via Binder)

Following the Vietnam War the Marines mothballed most if not all of their flamethrower tanks at Barstow, California in case the need for them should arise again. The wooden boxes contain various fittings which will be used to recondition the tanks if they are reactivated. (USMC via Binder)



M88 Tank Recovery Vehicle

One of the lessons learned during World War II was the importance of recovering damaged tanks from the battlefield. The United States fielded its first tank recovery vehicle when obsolete M3 Lees were converted to this role. Designated M31s, these were soon followed by the M32 series, based on the chassis of the M-4 Sherman, and during the Korean war the later M4A3 Sherman was converted to the M74 Tank Recovery Vehicle. However, the inability of the Sherman based recovery vehicles to adequately handle the heavier M26 Pershing and M46 Patton, especially in the rugged terrain of Korea, prompted the army to begin work on a new recovery vehicle in early 1954.

Unfortunately, two diverse points of view as to which vehicle the new tank retriever would be based on came up. Continental Army Command (CONARC) wanted to use the basic chassis and components of the new M48 Patton while the Ordnance Department favored the new experimental T95 chassis, which was under development, and was felt to be the tank of the future. Eventually, CONARC's view point won out and the M48 based T88 Tank Recovery Vehicle design proposed by Bowen-McLaughlin was accepted. This design, with front recovery operation, had been picked over one with rear recovery features proposed by Pacific Car and Foundry since CONARC felt a front end recovery vehicle better met army needs.

In April of 1956 Bowen-McLaughlin received a contract to build three pilot T-88 recovery vehicles, however, slowness in detailed design work and in finding a sub-contractor to cast the hull, caused serious delays in building the pilot models. These delays allowed the Army to reconsider the entire T88 program. Since the T95 (M60) was nearing production and could very well be in production at the same time as the T88, it was suggested that the T88 be cancelled and a new recovery vehicle be designed using T95 components. It was further suggested that since there were so many M48 tanks available a *conversion kit* be produced that would turn the M48 into an *interim* tank recovery vehicle.

By the time the pilot T88s were finally delivered little was resolved, since tests showed that the AVI-1790-8 engine provided only marginal performance. However eminent production of the M60 firmly established the need for a fully tracked medium recovery vehicle. The more powerful 980 hp AVI-1780-6 coupled with an Allison XT-1400 transmission was installed in the T88, considerably increasing performance. A production contract was awarded to the now renamed Bowen-McLaughlin-York (BMY) Company under the designation M88 Tank Recovery Vehicle.

While M48 components were used the M88 configuration bore little resemblance to the M48 tank. The hull was longer, though its width was only a little less than the M48 tank. Atop the hull a rectangular crew compartment housed a commander, driver, and two riggers along with two winches under the floor plates and various items of equipment needed for recovery work. On the front of the lower hull a dozer blade was mounted that could be dug in to provide stability when the vehicle was lifting or winching. The vehicle could be used as a bulldozer if the need arose. However, this was not recommended unless absolutely necessary since the blade could easily be damaged, resulting in a serious restriction on the vehicles primary purpose. On the upper forward hull an *A-frame* hoist was mounted which folded onto the rear deck when not in use. The hoist was operated by two hydraulic cylinders which raised or lowered the boom as needed. The A-frame had limited movement fore and aft through adjustment of a crank.

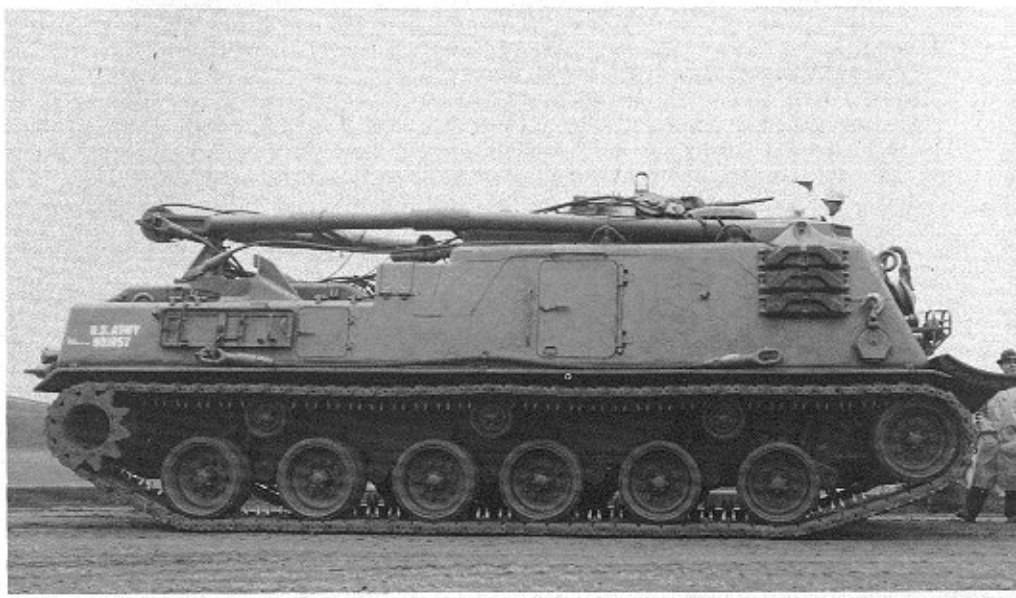
In addition to these external features, the M88 also possessed a number of capabilities which, though not as noticeable, aided it immensely in its intended role. Provisions were made so that the crew could pump fuel from the T88 to a standard tank. A hydraulics impact wrench was provided which was able to handle bolts up to 1.25 inches; this wrench could be hooked up to the auxiliary engine for use in the removal of suspension components.

Unfortunately, while the M88 had good recovery features, ballistically it fell far short of the M48 tank. This was to be expected since the M88 was not designed as a combat vehicle; nevertheless it was a distinct possibility that recovery work would take place under hostile fire. However, the need for good visibility, ease of approach to a disabled tank, and adequate internal space allowed little room in the design for a good ballistic hull shape. Initially, to help the crew stay inside the vehicle when recovering a tank under fire, it was proposed to provide the design with an automatic coupling device in order to remove the vehicle to a more secure zone, where the crew could then work outside. Two devices, one actuated hydraulically, the other electrically, were tested but neither were found to be acceptable. For self defense the M88 carried a flexible .50 caliber machine gun mounted atop the commander's hatch which provided almost no protection for the commander. However, during service in Vietnam, the machine gun mount was often fitted with a locally designed shield for protection from small arms fire or sharpnel.

M88A1

Quantity production began at the BME facility in Bair, Pennsylvania in February of 1961, with production continuing until February of 1964, during which over one thousand M88s were produced. In 1970 the production line was re-opened to overcome a serious shortage of M88s in the Army's inventory. Following the re-opening of the production line, plans were announced in 1972 to modernize the M88 design by installing the M60 diesel drive train, the Continental AVDS-1790-2DR and Allison XT-1410-4 transmission combination under the designation M88A1. This new version can be distinguished from the earlier models by the smoke launchers mounted on the upper front hull, although these will eventually be retrofitted to the M88 also.

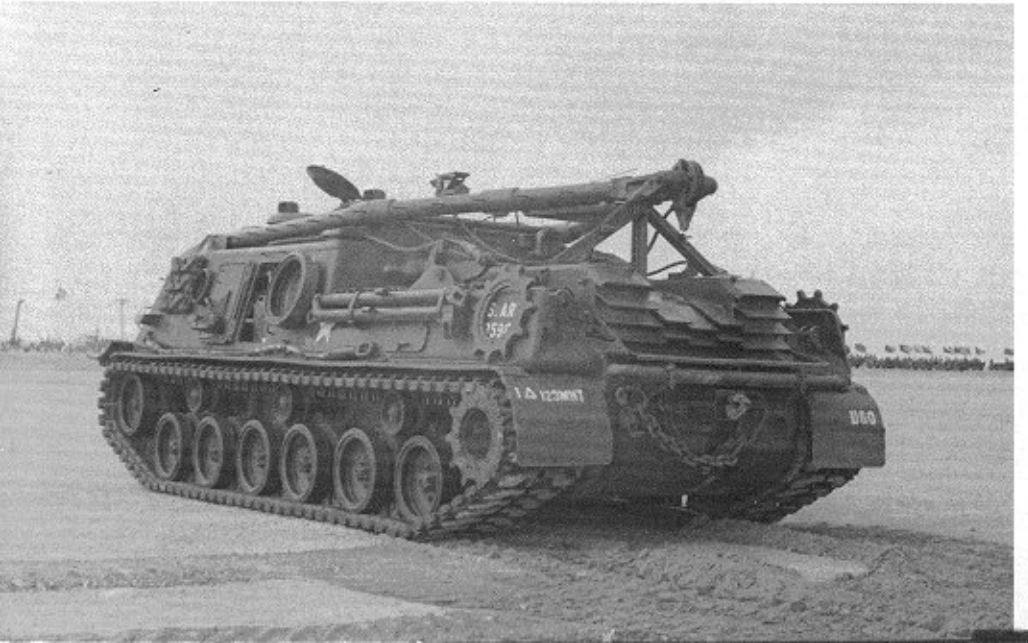
A number of M88s were supplied to American allies, although the bulk of the production run was used to equip the armored formations of the US regular Army, the US Army Reserve, and the US Army National Guard forces. Foreign users included Austria, Greece, Pakistan, and Tunisia. The only combat service which the M88 has seen was in Vietnam where they were employed by the Army to recover and repair damaged vehicles. In the rugged Vietnamese terrain the M88 proved itself a capable vehicle and was indispensable for recovering damaged vehicles. Unfortunately, there were never enough of them in Vietnam to fill the various armor and mechanized unit's needs. However without the M88, the armored units would have been unable to effectively operate in Vietnam.

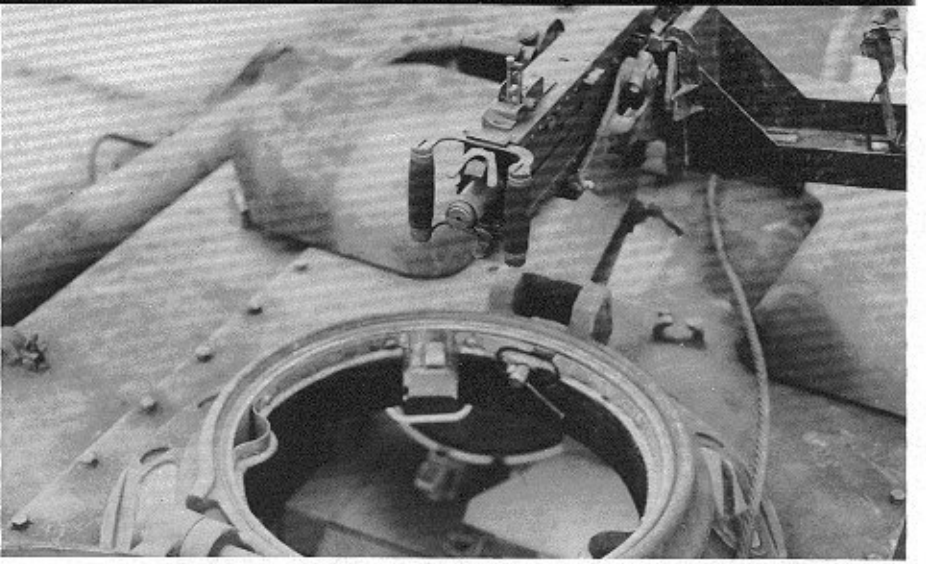


While loosely based on the M48 Patton design, the M88 Tank Recovery Vehicle bore little resemblance to the Patton tank, although as many components of the M48 as possible were used. This is one of the original T88 test vehicles. The boom atop the hull can be raised to facilitate the movement or recovery of a damaged or bogged down vehicle. (US Army via Binder)

(Above) The T88 test vehicle demonstrates its ability to lift an M113 armored personnel carrier during tests at Aberdeen, Maryland during the spring of 1959. On production vehicles the machinegun turret cupola was deleted in favor of a hatch and open mount for the .50 caliber weapon. (US Army via Binder)

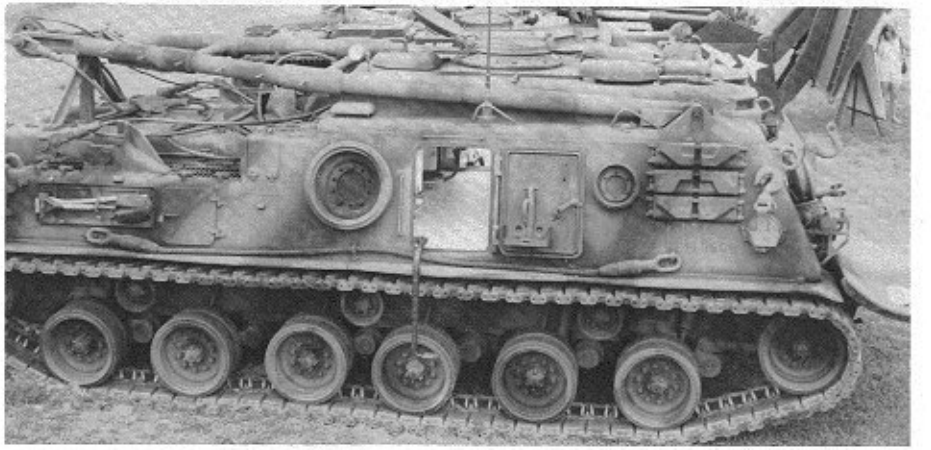
(Below) The production M88A1 recovery vehicle is covered with additional storage points for equipment. Other than relatively minor changes there was little difference between the T88 pilot vehicles and the M88 production vehicles. (US Army via Binder)





(Above) The machine gun cupola turret was replaced by a commanders hatch and machine gun mount. In Vietnam many M88s were field fitted with an armored shield on the machine gun to protect the vehicle commander from small arms fire. (Binder)

(Below) The spacious interior of the M88 can be seen through the side door. This allowed for storage of extra gear or room for crews from damaged tanks. The vehicle is painted in one of the new camouflage schemes. (Binder)



(Below) Besides equipping the regular Army the M88 also serves in the ranks of the reserve and national guard forces. This vehicle is from the 205th Infantry Brigade at Fort Snelling. (205th PAO via Binder)

M48 Armored Vehicle Laying Bridge (AVLB)

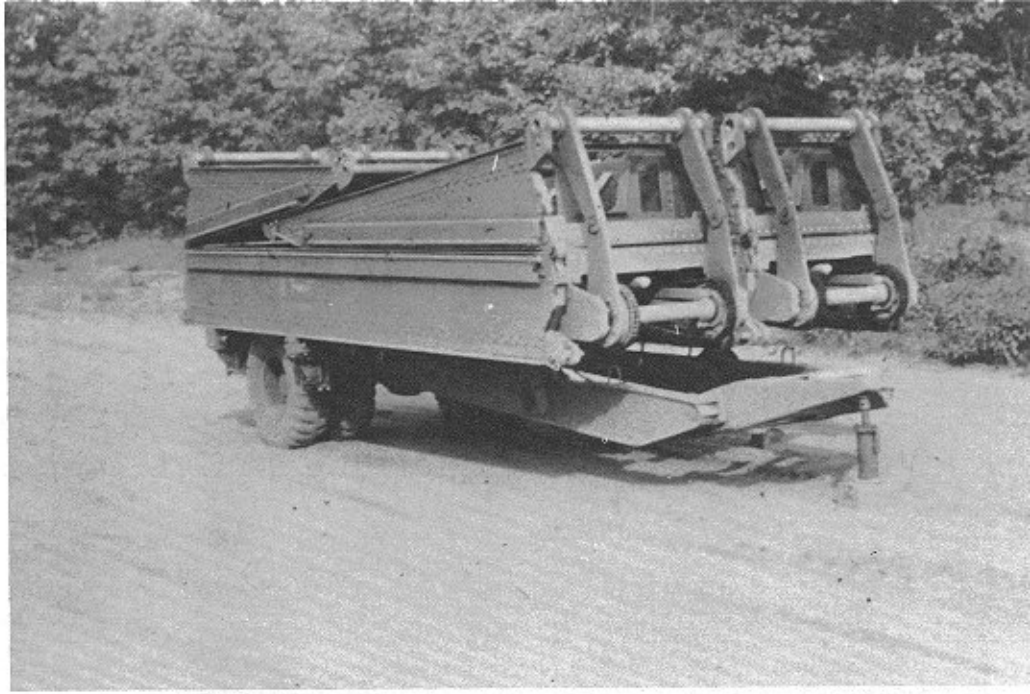
Tank mobility can be seriously hampered by small streams and gulleys. To counter these terrain obstacles the armored vehicle launched bridge (AVLB) was created during World War Two to span these small obstacles. Following the Second World War the United States experimented with a number of mobile bridge designs including a *push-along* bridge with a geared actuating mechanism, and a hydraulically operated scissors bridge mounted on the M46 chassis. The former, though tested on the M48, proved unfeasible and was eventually dropped. The latter, initially intended for use on the M47 chassis, took so long to refine that when it was completed the army decided to use the M48 chassis in place of the M47.

To carry the bridge span and actuating mechanism, the turret was removed and the top of the M48 hull was modified with a carrying cradle and launching mechanism. The hydraulic launching mechanism, located on the front of the hull, held the two section bridge which could be tipped off the hull into a vertical position by means of a large triangular device. After the bridge was in the vertical position, a plate was lowered in front of the tank which shifted the weight of the span off the tank chassis and onto a point some six feet in front of the vehicle. Once this occurred, two hydraulic cylinders lowered the bridge over the obstacle and extended it from the folded position. Then, another cylinder compensated for any difference in height between the tank and plate. After this height adjustment the launcher chassis could be disengaged from the bridge span by means of a quick release coupling. These couplings were fitted to both ends of the bridge which allowed the AVLB to re-engage either end of the span upon completion of the bridging operation.

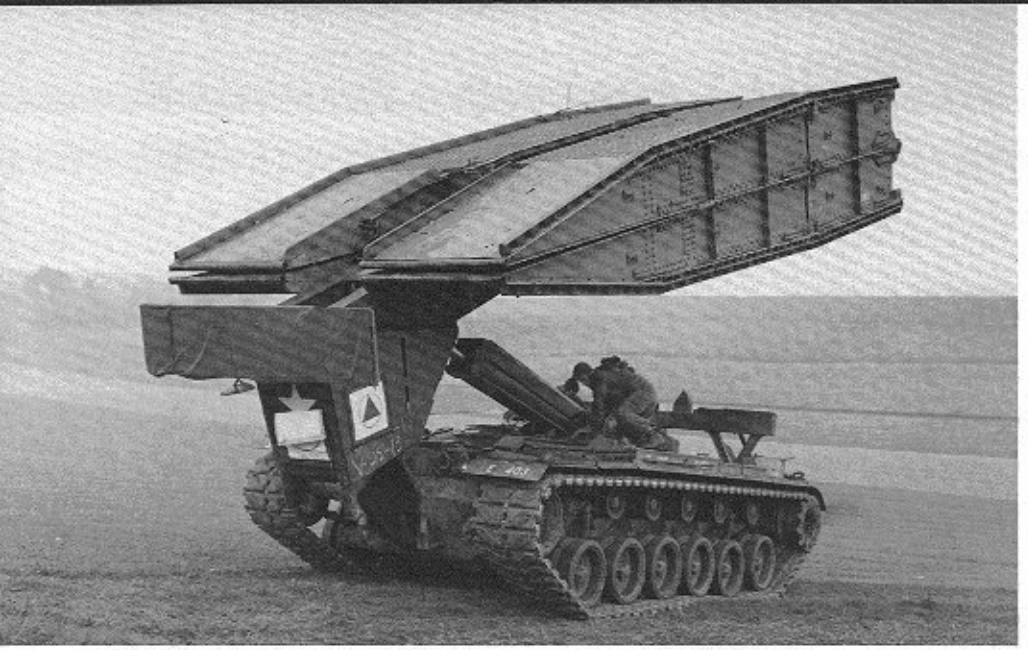
The bridging spans were aluminum with steel reinforcement and came in two lengths, 43 feet, or 63 feet. However, since the larger span did not significantly hinder the vehicle's mobility and was able to satisfactorily span nearly 60 per cent of the obstacles anticipated in Europe, the 63 foot span became the one most commonly carried by the bridge layer. Each half of the span was identical to the other and weighed approximately seven ton. When the bridge was folded on the M48 chassis the width of the tank was increased by three feet, and the overall height was raised an additional two feet.

Initially, the AVLBs made use of both the M48 and M48A1 chassis, normally minus the track tension idler. With the introduction of the M48A2, production was switched to this chassis, however, when the diesel updating program began on the earlier M48A1s, the bridge layer versions were not re-engined with the diesel. Eventually, in the late 1960s, the AVLBs were updated with diesel engines since the conversion was far cheaper than procuring additional AVLBs based on the M60. This diesel version became operational in the early 1970's and was substituted for the M48 variant. It used the same bridging system as the M48, with minor modifications due to hull differences and became the preferred AVLB in armored formations as the M48 AVLB model was assigned to reserve and national guard units.

The M48 AVLB saw service with the armored formations of Belgium, Germany, and Israel, and the bridging unit was modified for use by the Netherlands on their Centurion tanks. It is not believed that many M48 AVLBs were used in Vietnam, though the M60 version did figure prominently in the structure of the armored units committed to the conflict. No reports have surfaced as to whether or not the Israelis used their AVLBs in action, though the gullies which bisect the Golan Heights provided conditions under which their employment might have been required. The Israelis did use AVLBs in the Suez crossing, but only to span the gap between the shore and the pontoon bridges. At the present this model of the Patton will probably stay in the inventory of the various reserve and national guard formations well into the 1990's.

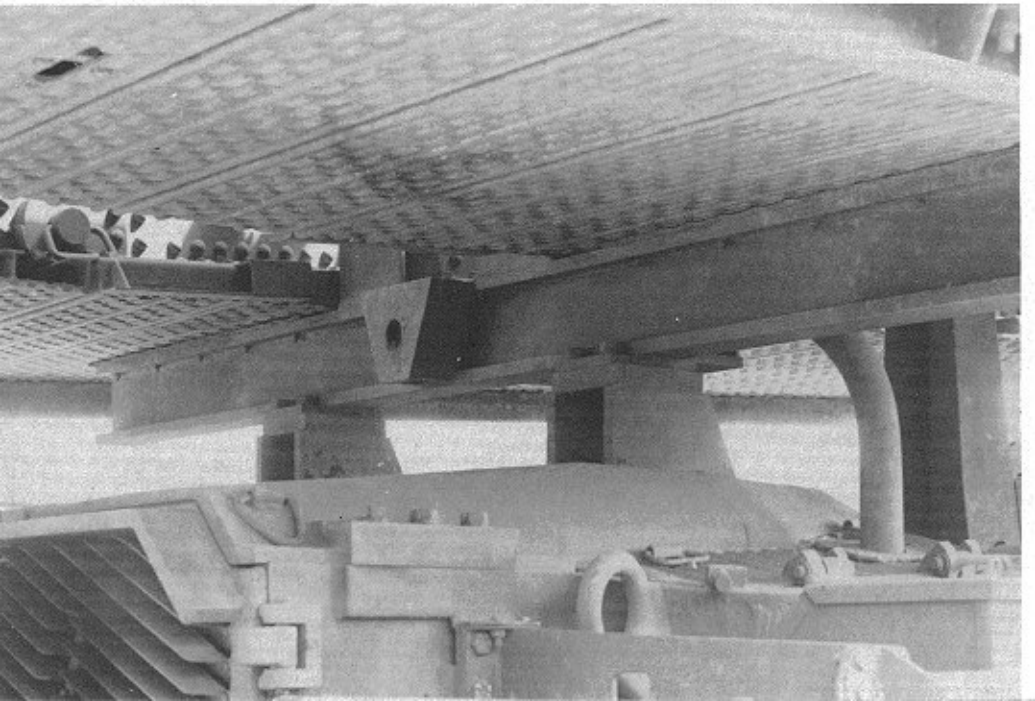


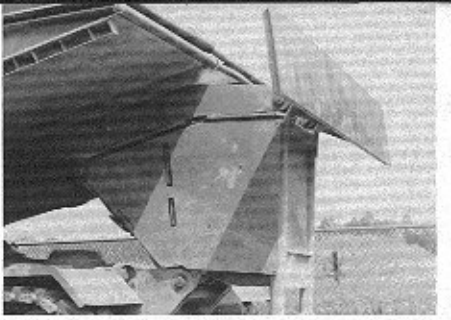
(Above and Below) Initially, a 'push along' bridge was tested to see if it had practical value as a bridging device under battlefield conditions. The folded unit was maneuvered into position by an M48, which then pushed it into an open position. Unfortunately the unit proved too cumbersome to be of practical value and was dropped in favor of the Armored Vehicle Launched Bridge (AVLB). (US Army Mobility Equipment, Research, and Development Command via Binder)

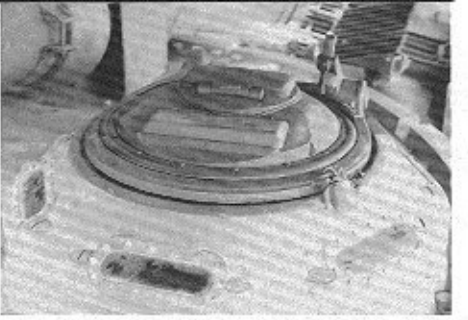


(Above) This early M48A1 chassis with its scissors bridge in a partially raised position. The actuating mechanism is connected to the box-like housing on the forward hull. This housing, with the large metal plate in front of it, provides the base on which the bridge rests as it is lowered into position by the tank. This vehicle is part of the aggressor forces during exercises in Germany, from 'C' Company, 2nd Bn, 33rd Armored, 3rd Armored Division. (US Army via Binder)

(Below) The bridge sits atop the tank on a large I-beam arrangement which runs across the rear engine deck. The only attachment point to the tank is the launching mechanism located on the front hull. (Mesko)

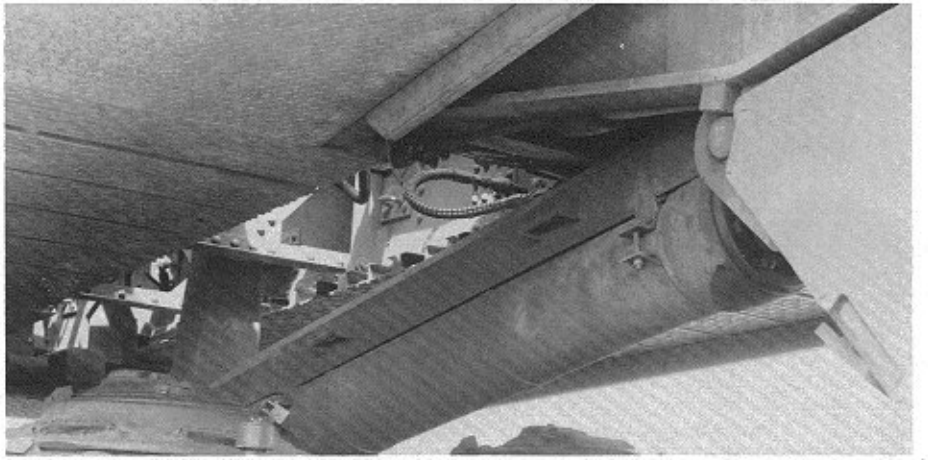






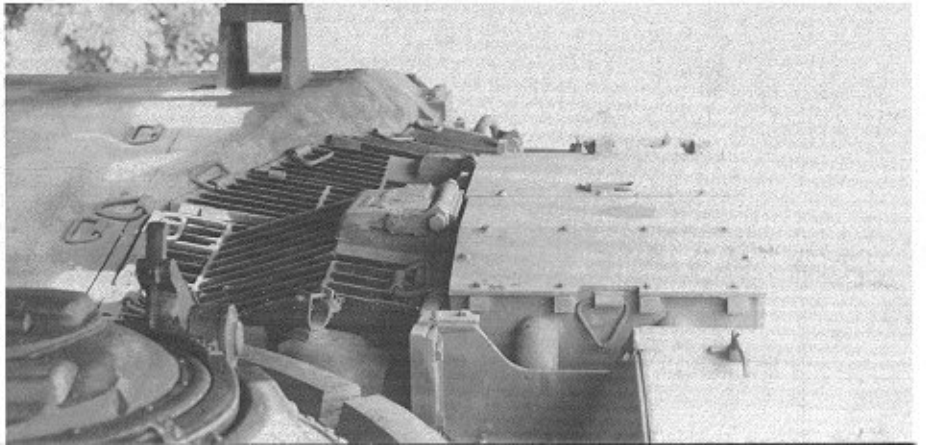
(Above Left) The launching mechanism to which the bridge is attached swings forward and tips the bridge off the tank chassis. The weight of the bridge is then transferred to the rectangular plate which becomes the ground base for the bridge when it makes contact with the ground. (Mesko)

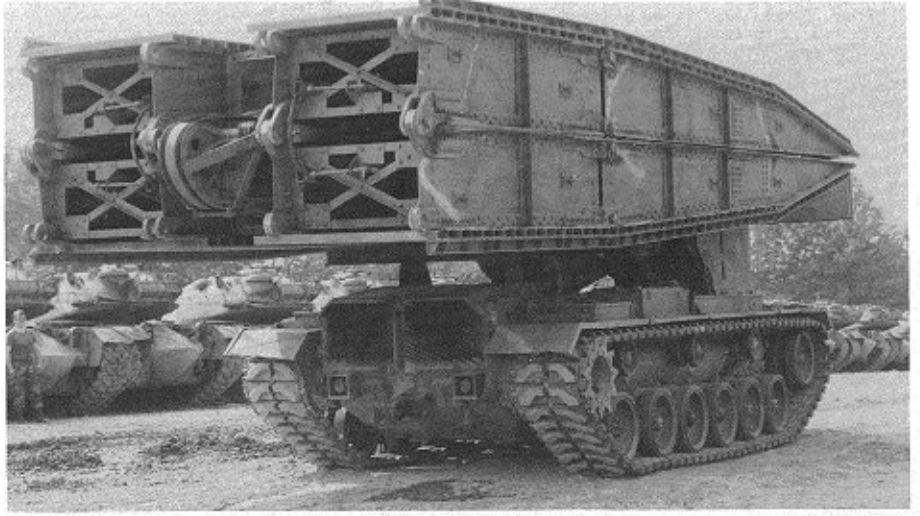
(Above Right) The commander and driver each have their own cupola mounted side by side above where the turret ring is on a normal M48 gun tank. (Mesko)



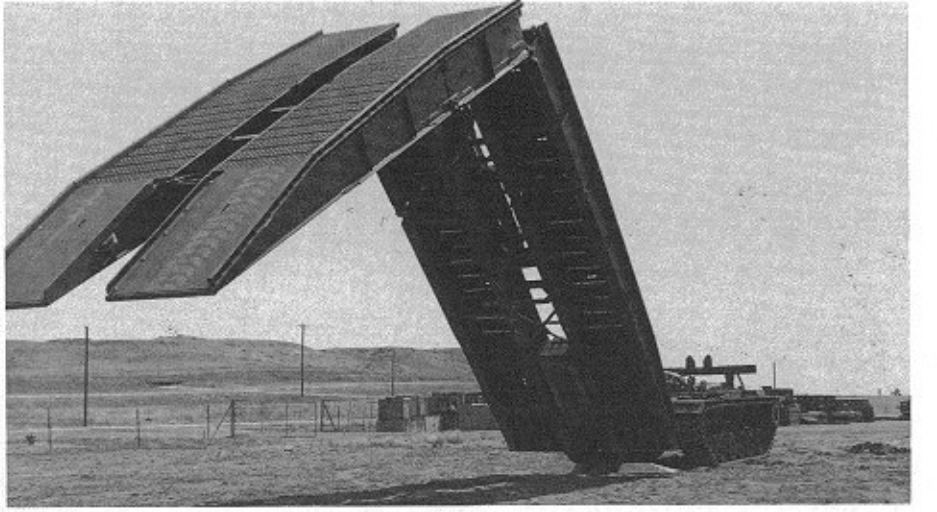
(Above) This cylinder is used to tip the bridge forward onto the ground as the massive triangular structure swings forward, after which the bridge slowly begins to open as it moves forward until by the time it reaches ground level it is fully open and perpendicular to the ground. (Mesko)

(Below) Some of the early M48 AVLBs have been upgraded with diesel engines since this modification cost much less than building M60 AVLBs. This M48 AVLB has the new top loading air filter as carried on the M48A5. (Mesko)

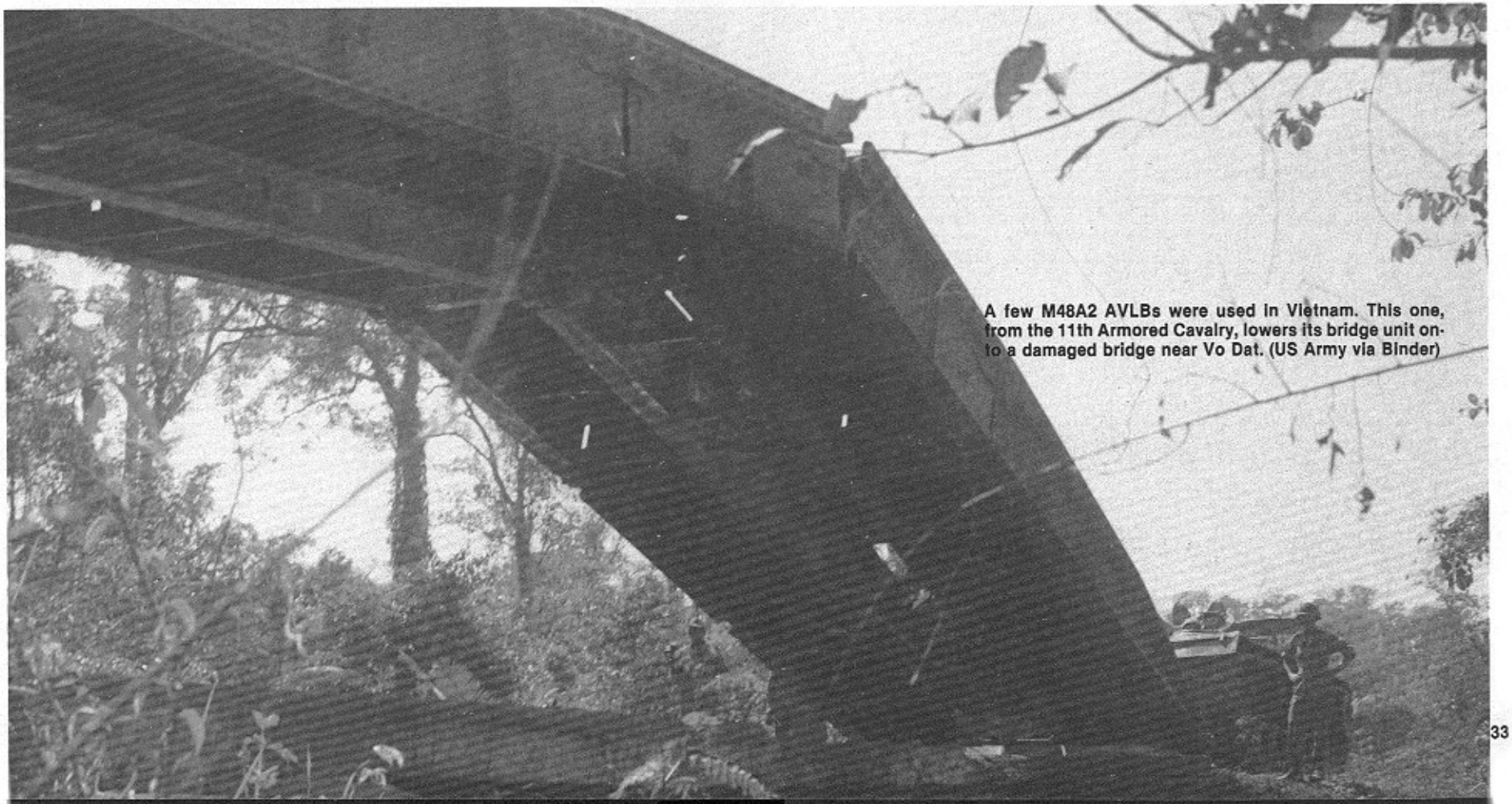




The rear of the M48 AVLB exposes the hinges and cables of the bridge. The camouflage pattern has been carried onto the bridge spans. (Mesko)



An M48A2 AVLB demonstrates how a bridging unit is lowered into place. Note how the plate serves as a fulcrum as the bridge is slowly lowered. (US Army)



A few M48A2 AVLBs were used in Vietnam. This one, from the 11th Armored Cavalry, lowers its bridge unit onto a damaged bridge near Vo Dat. (US Army via Binder)

Into Combat

The M48 was first *committed* to combat when American forces were deployed to Lebanon during the summer of 1958 in support of the Lebanese government against Syrian backed elements attempting a coup. M48A1 Pattons of the 3rd Marine Tank Battalion landed in support of Marine infantry units and were confronted on their journey inland by two Lebanese Army M3 Grants at a roadblock where a tense situation arose until the commander of the Grants received instructions to allow the Marine column to continue. Later the Marine M48A1s were joined by an Army tank battalion but neither unit became involved in a combat situation.

The next combat deployment for the M48 Patton came in December of 1964 when a Marine detachment was unloaded at the Vietnamese port of Da Nang as part of a *quick reaction* force to counter attacks by *Viet Cong (VC)* infiltrators. While this Marine force stayed only a week, the following spring, after a tremendous upsurge in communist activity, the United States decided to commit substantial numbers of troops to bolster the faltering South Vietnamese government. In March and April, elements of the 3rd Marine Tank Battalion came ashore with M48A3s as part of the III Marine Expeditionary Force sent to bolster the defenses at Da Nang. This force quickly began carrying out operations in support of Marine infantry patrols around the Da Nang area. The first major confrontation between the Marines and the *VC*, code named OPERATION STARLITE, occurred during mid-August when the 1st *VC* Regiment was trapped near Chu Lai by three Marine battalions, each supported by a tank platoon. In fierce fighting, the communist force was decimated, while US casualties were relatively light. The Pattons provided outstanding fire support for the Marine *grunts* and helped to keep the number of Marine casualties light while inflicting numerous losses on the *VC*. And while seven tanks were damaged, none were destroyed in the fighting. OPERATION STARLITE demonstrated that tanks could be employed in the Vietnamese countryside. One Marine armored column without infantry support was ambushed by the guerrillas in the dense jungle but managed to hold out until reinforcements arrived. This engagement highlighted the need for close infantry support when operating in the restricted visibility of the jungle. STARLITE, in the eyes of the Marines, more than justified the use of their Pattons in Vietnam and, showed that tanks could be used effectively in this type of jungle warfare.

The first use of the M48 Patton in combat came during the American intervention in Lebanon during the fall of 1958. A battalion of Pattons from the Marines and Army were committed to support the US troops which had been requested by the Lebanese government. This Army M48A1 from the 35th Armored Regiment, equipped with a dozer blade, clears a rebel roadblock in Beirut. (US Army)

The next combat use of Pattons came in Vietnam where US troops were sent to help the South Vietnamese government fight Viet Cong guerrillas and regular troops of North Vietnam. Despite objections from both the Army and Embassy personnel in Saigon, the Marines came ashore with their armored vehicles which included M48A3s. This Marine Patton comes ashore at Da Nang to bolster the Marine perimeter around the giant air base on the outskirts of the city. (USMC)

While the M48 Patton received its baptism of fire in Vietnam, the first use of the M48 in its intended role, tank vs tank, took place during the brief war which broke out between Pakistan and India late in the summer of 1965. India, outraged by Pakistani support of guerrillas in Kashmir, launched a strike against Pakistan which quickly escalated into full fledged warfare. In an effort to trap Indian elements driving toward Lahore, the 1st Pakistani Armored Division, equipped with both M47s and M48s, launched an attack against the southern flank of the Indian drive. Unfortunately the initial Pakistani thrust was not pressed home, giving the Indians time to prepare a trap. On 10 September, the Pakistani's launched a major assault against Indian elements dug in around Asal Uttar. Advancing through high cane fields which limited visibility, and with little infantry support, the Pakistani M48s were hit by an avalanche of tank, recoilless rifle, and artillery fire. Unable to locate the source of the fire in the high cane, the Pakistani Pattons took terrible losses. A Pakistani drive to flank the Indian positions became bogged down in swampy ground and also suffered heavy losses. By nightfall, both Pakistani drives had petered out. When the sun rose the next morning nearly one hundred tanks from the Pakistani 1st Armored Division, including numerous M48s, littered the battlefield around Asal Uttar. In fact this area became known as the *Patton Nagar* - the Patton Graveyard.

While the Pakistani 1st Armored Division was being routed at Asal Uttar, another Indian thrust threatened the Pakistani forces in the Sialkot sector. Indian forces, including the 1st Armored Division tried to drive a wedge between Pakistani forces in the area. Fighting a delaying action, Pakistani armored elements, including M48s, extracted a tremendous toll from the attacking Indian forces. For over a week, the battle raged and by 17 September, the Indian drive had been contained. Pakistani losses, though heavy, were approximately one third those of the Indian forces.

Unfortunately, as a result of the debacle at Asal Uttar, the Patton came out of the war with a severely tarnished reputation. An objective view of its performance, however, showed that the M48s poor performance was due more to poor tactical planning and outright blunders than any inherent design problem. The only significant trouble Pakistani crews experienced was with the range finding system, which proved difficult for the gunners to

Following the commitment of American troops to Vietnam, it was only a short time before permission was given to the US commander, General Westmoreland, which allowed him to commit US troops offensively in action. The first use of troops against the Viet Cong came in the late summer of 1965 when the Marines, supported by armored units, trapped a VC regiment near Chu Lai. M48s were extremely helpful in providing support for the 'grunts' and proved that armor could be used in the Vietnam countryside. This Marine M48A3, equipped with wading gear, covers the evacuation of wounded marines by an H-34. Notice the relatively clean and uncluttered appearance of this tank when compared to later in the war. (USMC)

While the Patton was blooded in Vietnam, it had yet to take part in tank vs tank action. However, during the late summer of 1965 the M48 received its baptism of fire when India and Pakistan went to war. Unfortunately, Pakistani misuse of the M48 resulted in an undeserved tarnished reputation for the Patton. This Pakistani M48 lies off the side of a road after being hit by Indian anti-tank fire, the tread has been completely shed from the right side. (Icks via Binder)

operate under combat conditions. The rangefinding system had also proved to be troublesome for US tank crews, however, the problem lay chiefly in the need for constant training rather than any deficiency of the design. The Patton's poor performance at Asal Uttar during the Indian-Pakistani war reflected little on the quality of the M48 design. At Salkot, the Pattons, though heavily outnumbered, were well handled and accounted for many Indian tanks, unfortunately their performance in this battle has largely been overlooked.

It was nearly two years before the M48 Patton was again to see action in the tank vs tank role. In June of 1967, Israeli armed forces launched a pre-emptive surprise attack against both Egypt, and Syria who were busily preparing their own attacks against Israel. The Israelis had received over one hundred M48A2Cs during the early 1960s from the government of West Germany as part of the war reparations to the Jewish people. While generally pleased with the new tank, the Israelis felt that the Patton's 90MM main armament was not powerful enough to combat the newer 100MM armed tanks supplied to the Arabs by the Soviet Union, and began re-arming their Pattons with 105MM guns. Unfortunately, when the war broke out little more than one company of M48s had been re-armed. However the Israeli 90MM M48A2Cs performed extremely well against the more heavily armed and armored Soviet tanks equipping the Egyptian and Syrian armies. Pattons were used primarily in the Sinai sector where they spearheaded the armored group (Ugda) of General Tal when the Gaza strip was invaded. During the battle at Rafah Junction the Pattons outfought heavy Stalin III tanks equipped with a 122MM gun, gaining a decisive victory. In their drive across the Sinai Desert toward the Suez Canal, the Israeli Pattons consistently gave better than they got, despite the Egyptians being in defensive positions. The M48's mechanical reliability proved its major asset with few of them suffering mechanical breakdowns during the long hard drive across the desert. In fact, the Israeli army was so impressed with the Patton's performance, that after the war they made a special effort to obtain additional Pattons with which to replace their obsolete M4 Shermans. However, the high cupola turret was not well liked by the Israeli tank crews.

Facing the Israelis on their eastern border, the Jordanian army had nearly 300 of the earlier M48s and M48A1s. These equipped the 40th and 60th Armored Brigades which were stationed near Damiya and Jericho respectively. And although the Israelis tried to avoid a conflict with Jordan, King Hussein opted to come into the war on the side of Egypt and Syria. The initial Israeli thrusts toward Jerusalem, Hebron, and Jerrin resulted in some confused movements by the Jordanians to counter the Israeli attacks. Unfortunately these initial movements exposed the Jordanian Pattons to numerous air attacks by Israeli aircraft and a large number of their tanks were lost. Fierce tank vs tank fighting also took its toll of Jordanian armor, but the Jordanian crews fought hard against the Israelis. After the war the Israelis admitted that the Jordanians were by far the toughest opponents they faced in the conflict. Not withstanding this, the Jordanian 40th and 60th Armored Brigades were totally mauled and were forced to retreat across the Jordan river with less than two dozen M48s left. A large number of Jordanian Pattons were recovered and reconditioned for use by the Israeli army.

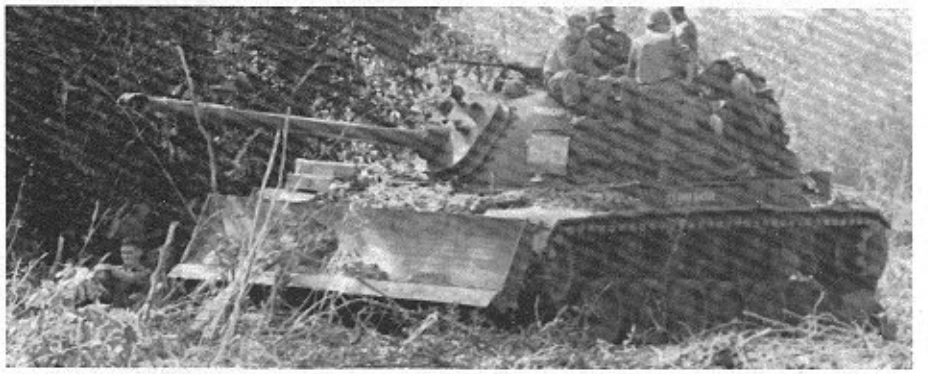
While the Patton was showing its mettle on the battlefields of the mid-East its use in Vietnam was also beginning to grow. Initially, despite the successful employment which the Marines experienced with their M48s, the Army was reluctant to commit armor to Vietnam. In fact some infantry formations were stripped of their armor prior to being shipped to South Vietnam since the Army felt that armor would serve little useful purpose in the jungle. Eventually, however, an M48 squadron was released for duty in-county to test its effectiveness, but was operated under heavy restrictions. Finally in March of 1966 the 25th Infantry Division was allowed, due to its commander's insistence, to test the M48 and other AFVs in combat. During operations north of Saigon the 25th proved that the M48 could be effectively be used in the jungles of Vietnam. As a result additional M48 units were deployed and confirmed what the 25th Infantry had pioneered. By early 1967, opposition to the use of armor in the jungle terrain of Vietnam had largely disappeared. In particular the use of Pattons during OPERATION CEDAR FALLS and JUNCTION CITY helped convince Army command that tanks could perform a vital function in the ever expanding war.*

From CEDAR FALLS and JUNCTION CITY onward Pattons were employed in almost

**For complete coverage of the use of armor in Vietnam consult the author's ARMOR IN VIETNAM also published by Squadron Signal.*

After the debacle of the Indian-Pakistani War it was nearly two years before the Patton again saw action in the tank vs tank role. As part of a settlement between Israel and Germany over 100 Pattons were supplied to the Israeli Defense Force (IDF). This M48A2C takes part in a parade prior to the outbreak of the Six Day War between Egypt, Syria, Jordan, and Israel. The commanders .50 caliber cupola on the Patton was disliked immensely by the Israeli tankers and was later replaced by a cupola very similar to the one on the M48. (IDF)

During the Six Day War Israeli Pattons saw heavy action in the Sinai Peninsula as part of General Tal's force. These M48A2s lead a column during the drive toward the Suez Canal. A searchlight is mounted on the mantel of the lead Patton. (Israeli Embassy/Gutman via Binder)



While the Patton design was being vindicated on the battle grounds of the mid-East by the Israelis, it also received vindication of sorts in Vietnam where the US Army finally realized that the vehicle could be used effectively in the varied terrain of that country. Slowly, at first, the army sent selected armored units to Vietnam, gradually increasing their number as results in combat supported the contention of armored officers of the worth that tanks could be to infantry units. This Patton, fitted with a dozer blade, takes part in OPERATION CEDAR FALLS, one of the first large scale uses of armor by American forces in the Vietnam War. (USAF)

every major operation in Vietnam except for those in the mountainous areas and the Mekong Delta. Primarily used to support infantry units during sweeps through suspected communist bases, they were also employed for road clearing duties, convoy escort, and base defense. Some M48s were fitted with minesweeping gear to clear roads of Viet Cong explosive devices. This gear was composed of a series of bogey wheels which detonated any mines it rolled over. Unfortunately the device was heavy and awkward which restricted it to roads, but nevertheless the device did a creditable job when employed under the right conditions. The *Viet Cong*, experts in ambushing convoys, did not shy away from attacking lucrative targets inspite of tanks being present, and the Patton crews soon found that these attacks could be deadly. To counter these attacks the *herringbone* formation was developed in which each armored vehicle alternately pivoted left or right at the first indication of trouble, thus covering both sides of the road with a curtain of fire. This tactic helped repel an initial assault and gave the formation time to counter an ambush. When not employed in the field, Pattons were used to bolster the defenses of base camps, often being protected by sandbag bunkers and wire mesh to protect them against the effect of rocket propelled grenades.

Only once during the Vietnam War did American tank crews encounter communist armor in strength. In March of 1969, under the cover of darkness eight North Vietnamese PT-76s and some armored personnel carriers (APCs) attacked the Ben Het Special Forces camp where a platoon of M48s was located. Two PT-76s and an APC were destroyed in the ensuing firefight while only one Patton received minor damage. During the spring of 1972, following the withdrawal of US combat forces, the North Vietnamese launched a major offensive, supported by large numbers of T54/T59s and PT-76/Chincom Type 63s. To counter this the South Vietnamese committed a newly activated Patton regiment against a major thrust across the DMZ. And while the regiment lost all of its M48s as it retreated, none were destroyed by enemy armor. The majority of the regiment's losses were due to enemy anti-tank fire, missiles, lack of spare parts, or running out of fuel. In exchange, however, over ninety enemy tanks were destroyed. Following the peace treaty in 1973, additional Pattons were supplied to the South Vietnamese to rebuild the shattered regiment and create new armored units. Unfortunately, these played no major role in the 1975 North Vietnamese offensive and there were few if any significant encounters with enemy tanks during the fall of South Vietnam. It is not known at the present time if any of the captured M48s have been used by the North Vietnamese in their invasion and occupation of Cambodia.

(Above) As the war progressed, tactics were worked out to counter ambush attacks by the communists against allied convoys. These Pattons have assumed the 'herringbone formation' to provide all round fire against possible enemy attack from the dense jungle on either side of the road. Alternating vehicles would pivot outward to one side while any softskinned equipment would seek shelter from the ambush or push on to a safe position. (US Army)

(Below) The M48 proved especially helpful in securing lines of communications and providing security to support units. 'Wild One 4' covers a group of engineers while they remove mines laid the night before by the VietCong. (US Army)

(Below) M48s also proved to be effective 'jungle busters' for the 'grunts' who could follow in the tank tread marks without fear of mines. However the enemy began rigging trip wires to catch the turret or antennas of the Pattons which on occasion resulted in severe casualties for both tank crews and accompanying infantry. (US Army)

M48A4

During the early 1960s the Army made plans to arm some of its M60 main battle tanks with the M60A2 Shillelagh guided missile turret. Since this would have made a large number of 105MM armed M60 turrets available, the army proposed mounting these newer turrets in older M48A1s to upgrade their fighting ability and at the same time bring the M48A1s up to M48A3 standards using conversion kits. Two pilot conversions were made by Chrysler under the designation M48A1E3. After evaluating these modified Pattons the Army decided to go ahead with the conversion project re-designating them to the M48A4. Unfortunately the M60A2 Shillelagh system ran into numerous problems and the anticipated supply of M60 turrets did not materialize. As a result the entire conversion project was cancelled. Eventually the Shillelagh system did enter production after a long test program, but by then other plans had been drawn up for rearming the older M48s with the 105mm gun. Thus aside from the initial conversions no further M48A4s were procured by the Army and even these vehicles were technically referred to by their original designation of M48A1E2.

Israeli M48A4

This, however, was not the end of the *M48A4* designation, it is often used when reference is made to modified Israeli Pattons. During the early 1960s when the Israeli government tried to convince the US to supply it with M48s to counter the large quantities of Soviet T-54s being supplied to the Egyptian and Syrian armies, the American government publicly balked at the Israeli request, but secretly helped arrange the transfer of over 100 M48A2 and M48A2Cs from West Germany. To counter the more heavily armed Soviet supplied tanks the Israelis decided to rearm these M48A2s with M68 105MM guns, but by the time of the 1967 War only a handful had been so armed. After the 1967 War the US changed its policy and the Israelis were able to obtain close to a thousand additional M48s. By this time the Israelis had decided to convert all their first line tanks to the Continental AVDS-1790 diesel engine and the M68 105MM gun. Thus, the majority of the Israeli M48s had their engines replaced and were up gunned. In addition, the commanders cupola, which the Israelis had disliked due to its cramped conditions, poor visibility, and excessive height, was replaced with a low profile Urdán cupola similar to the original one used on the M48. The .50 caliber machine gun was replaced with a .30 caliber weapon, which the Israelis believed was more effective against personnel and soft skinned vehicles. This Israeli conversion would form the basis for the US Army upgrading of its older Patton fleet during the mid-1970s.

This Patton chassis has been modified to accept the 105MM armed M60 turret to test the feasibility of combining M60 turrets, made available by the Shillelagh Program, with the M48A1 hull in an attempt to upgrade the firepower of the M48. Other modifications to the M48A1 hull included the addition of a diesel engine and T-142 tracks. Unfortunately the surplus of M60 turrets did not materialize and the project was dropped. (US Army via Binder)

The Israelis decided to upgrade their M48s by rearming them with 105mm cannons and changing the powerplant to the AVDS-1790 diesel engine. This upgraded Israeli Patton was sometimes referred to the 'M48A4' by the US Army for purely administrative purposes. These 'M48A4' Pattons, on patrol in the Sinai just prior to the 1973 Yom Kipper War, are still fitted with M1 cupolas. (IDF)

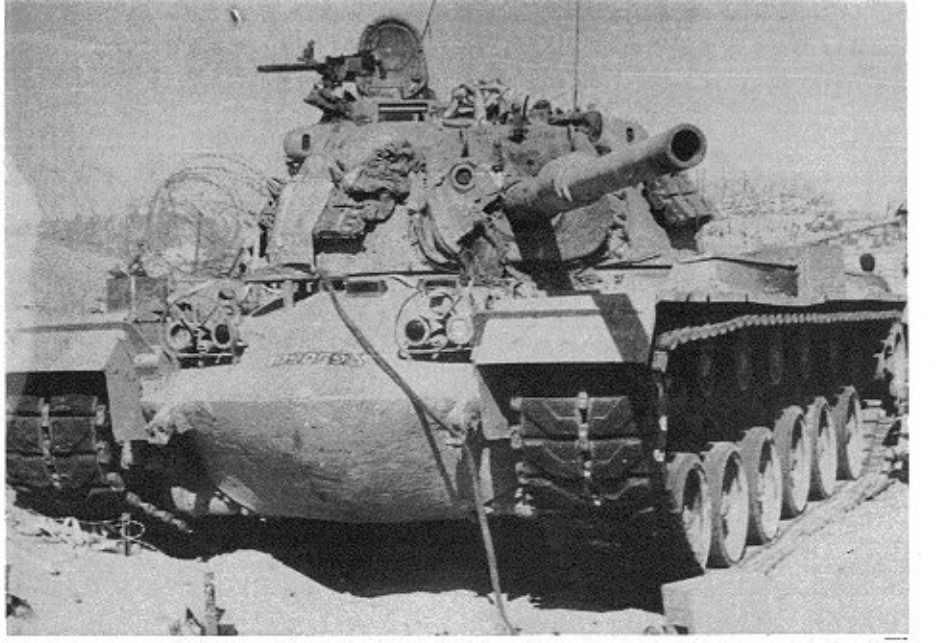
These Israeli 'M48A4s' have been fitted with the new Urdan style cupola which was very similar to the early type of cupola found on the M48. The Israelis often substituted a .30 caliber machine gun for the commanders .50 caliber weapon as they felt the heavier gun did not offer any real advantage over the smaller weapon. (IDF)

The Yom Kipper War

By the early fall of 1973 the situation in the mid-East had again reached a boiling point. Egypt and Syria, unable to get concessions out of Israel by political means, and being beaten in numerous skirmishes with the Israeli army and air force, decided to launch an all out attack against Israeli positions in the Golan Heights and along the Suez Canal. While the bulk of the Israeli armor in the Golan area was made up of British Centurions, the majority of the Israeli tanks along the Suez Front were Pattons. Despite warnings of an imminent attack by its intelligence section, the Israeli armed forces and government were caught off guard by the sudden Egyptian and Syrian attack on October 6th. The initial Egyptian assault broke through and isolated Israeli strongpoints, known as the Bar Lev line along the Suez Canal. With only some one hundred tanks available near the front, the Israeli army tried to fight its way through the Egyptians to relieve the Bar Lev strongpoints and blunt the Egyptian crossings. Unfortunately for the M48 crews, the Egyptians were well equipped with rocket propelled grenades (RPGs) and Saggar anti-tank missiles. The Israeli tankers, without adequate artillery or infantry support, advanced into a giant ambush. Patton after Patton was hit, and although a few were able to fight their way through to the canal, little was achieved against the massed Egyptian forces. A second Israeli counter-attack also ran afoul of the dug-in Egyptian forces and it too was repulsed with heavy losses.

Realizing that such attacks played into the hands of the enemy, the Israelis dug-in and rebuilt their armored strength, and waited for the enemy to come to them. On 14 October the attack finally came, massed formations of Egyptian armor moved in long files toward the dug-in Pattons. When the lead tanks were only a few hundred feet away all hell broke loose as the Israelis unleashed an avalanche of fire. Egyptian T55s and T62s literally disintegrated as Israeli artillery added to the carnage. Over 600 smoldering hulks of Egyptian tanks and vehicles lay among the sand dunes, victims of the accurate Israeli gunners.

(Below) The surprise attack of Syria and Egypt that started the Yom Kippur War caught the Israeli Army by surprise. With only limited forces in the Sinai and along the Bar-Lev line the Israelis were unable to withstand the initial Egyptian onslaught. The first Israeli counter attack failed to push back the Egyptian advance. This 'M48A4' moves toward the enemy bridgehead. (Israeli Embassy/Gutman via Binder)



(Above) A few tanks were able to break through to reinforce the isolated Israeli fortified positions along the Bar-Lev line and bring the Egyptian assault under fire, but to little avail. This Patton was knocked out at one of the strongpoints and later captured by Egyptian forces. (Egyptian Embassy via Binder)

(Below) Unfortunately the early Israeli counter attacks were not adequately supported by infantry or artillery, and ran afoul of numerous Egyptian anti-tank teams which lead to heavy Israeli losses. This burned out A4 sits quietly in the desert after one such attack. (Egyptian Embassy via Binder)

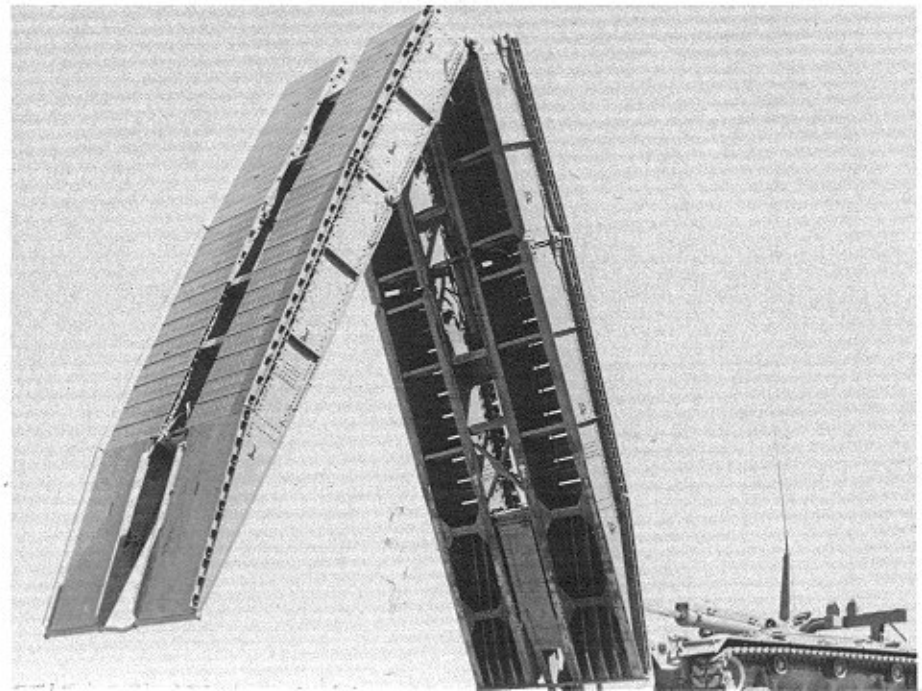
Once this Egyptian attack was destroyed, the Israeli High Command gave the order for a counterattack. Under the command of General Ariel Sharon, the Israelis drove a wedge between the Egyptian forces near the Great Bitter Lake and pushed on to the Suez Canal. Despite heavy resistance, Israeli tankers were able to secure a portion of the shoreline and ferry a few M48s across to the western side of the canal. These Pattons fanned out disrupting Egyptian anti-aircraft positions, lines of communications, and supply depots. Other Pattons towed huge bridging sections into position for a causeway over the canal. In an attempt to disrupt this crossing, the Egyptians launched a series of attacks against the Israeli positions defending the bridgehead area. During the vicious fighting opposing tanks were often only a few feet apart. Reinforced by another division, Sharon's forces held their ground and expanded their bridgehead, effectively isolating the Egyptian 3rd Army. In an effort to break through the Israeli lines, the trapped Egyptians launched a number of assaults which Israeli tankers repulsed with huge Egyptian losses.

Eventually, a UN ceasefire was agreed to by the warring parties. During the relatively short time in which the fighting took place the two Arab states lost over 6000 vehicles, including over 2500 tanks. However, the Israelis also suffered heavily, losing nearly half their original tank strength. Fortunately most of these were subsequently recovered and additional tanks were rushed to Israel from the United States. The M48 Patton again proved itself against far more modern Russian equipment; and despite early losses in the

(Below) Once the Israelis got over their initial shock at the fierce resistance offered by the Egyptians they soon adapted their tactics to the new style of fighting. More infantry in M113 APCs supported the Israeli armor and more artillery support was provided during the attacks to keep the enemy pinned down. This Patton is advancing toward Egyptian position during the final stages of the war. (Israeli Embassy/Gutman via Binder)

(Above) In an effort to turn their fortunes around in the Sinai the Israelis made a daring thrust across the Suez Canal between the Egyptian 2nd and 3rd Armies. This 'M48A4' crosses over the canal on a pontoon bridge near Great Bitter Lake. As a result of this daring and brilliant attack the Israelis were able to reverse their positions on the battlefield and soundly defeat the numerically superior Egyptians. (Israeli Embassy/Gutman via Binder)

(Below) The Israelis had received a number of M48A2 AVLBs after the Six Day War. However these were of little use during the Suez Canal crossing due to the limited length of their spans. (IDF)



Sinai, the Pattons performed very well throughout the entire campaign, bearing the brunt of the fighting in this sector. Though some losses occurred as a result of poor tactics, especially in the initial counterattacks, the overall performance of the M48 was exceptional. Many tanks continued to operate in spite of multiple hits from RPGs and anti-tank missiles. During the main Israeli counterattack which eventually resulted in a decisive victory the Pattons played a key role in securing and holding the bridgehead across the Suez. In tank vs tank action the M48 completely dominated the Russian built T55 and T62, though much of this must be credited to the superbly trained Israeli tank crews. Unfortunately many Pattons were totally destroyed in the fierce fighting. To off-set these losses the US rushed hundreds of newer M60s from depots in Europe and the United States. Since the war, the M60 has begun replacing the M48 as the chief American tank in the Israeli inventory. And while the Patton will continue to serve for many years to come, it is highly doubtful if significant numbers of additional M48s will be acquired by the Israeli army.

(Above) An upgraded Israeli 'M48A4' with the early .50 caliber M1 commanders cupola during the Sinai campaign. Normally the Israelis replaced this cupola with their own Urdan cupola of lower height which offered better protection. (IDF via Haugh/Binder)

(Below) However, AVLBs were used to bridge the gap between the pontoon bridges and the shoreline. Two Pattons follow an M60 bridgelayer over one of the pontoon sections on the Great Bitter Lake as reinforcements for the Israeli forces on the west bank of the canal move up. (Israeli Embassy/Gutman via Binder)

M48A5

The need to build up US tank strength in the early 1970s resulted in the final upgraded version of the M48 Patton design. This was brought about by three factors. First, the newly developed MBT-70 had proven to be a costly failure, leaving the US Army without a replacement for its aging Pattons. Second, a delay in M60A2 production, left the US seriously short of tanks worldwide. And third, as the US rushed hundreds of M60s to Israel to replace losses in the 1973 Yom Kipper War, American tank inventory was depleted to a dangerously low level.

In an attempt to rectify this shortage of tanks as quickly and inexpensively as possible, the Army decided to modify M48 Pattons with M60 component parts to bring them up to M60A1 standards under the designation M48A5. The modification program involved M48s, M48A1s and M48A2s that had been mothballed, along with M48A3s in active service.

Conversion of the M48A3 was relatively straight forward involving only eleven conversions kits, the M68 105MM gun and its associated gear in the turret along with some minor improvements in the track and other external fittings. However, the M48A1 required 67 separate conversion kits, not only the new 105MM gun, but also a revised fire control system, replacement of the older gasoline engine with an AVDS-1790-2D diesel engine, a new engine compartment and new rear deck. Since the Army directed that as much use as possible be made of Israeli experience in upgrading their M48 Pattons a number of improvements were introduced during production and retrofitted to earlier M48A5s. Initial M48A5 conversions retained the M1 cupola and G305 riser, but later in the program a new, low profile Israeli designed cupola was introduced. This cupola, the Urdan, lowered the overall height of the Patton and had a pop-up hatch that provided a full 360 degree vision to the commander with very little exposure. Based on experience in both Vietnam and the various mid-East wars the .50 caliber machine guns were replaced by 7.62 M60D machine guns at both the commander and loader positions. With the the Urdan turret this version was referred to as the M48A5 (Low Profile) to differentiate it from the early M48A5.

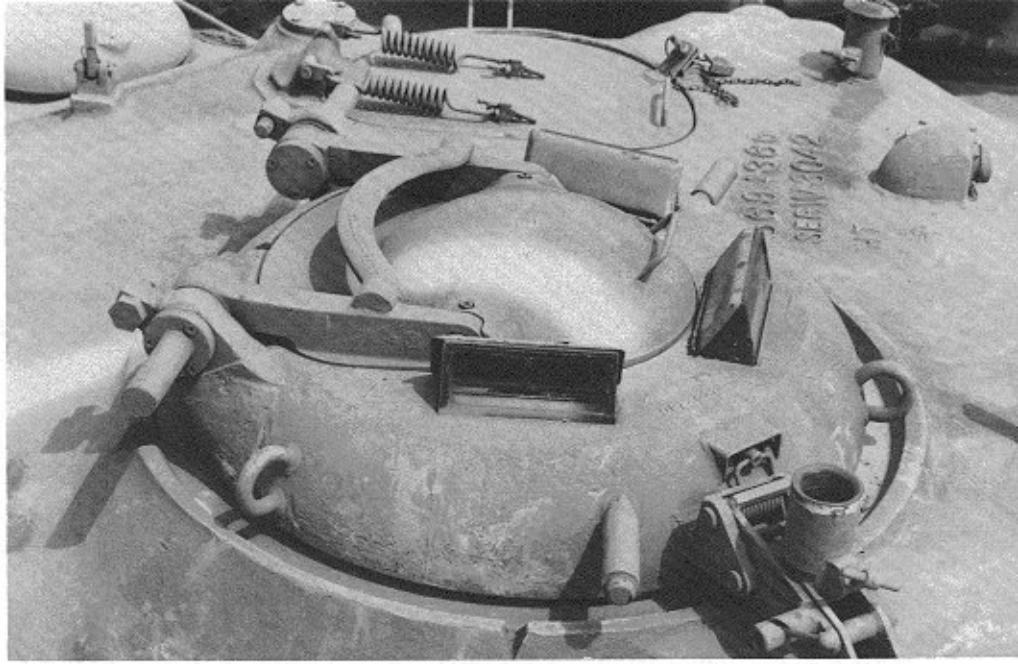
The results of this updating program provided the army with a much needed boost in its overall tank strength without a huge outlay of money, and in a relatively short period of time. By the beginning of 1976 the M48A5 was being distributed to National Guard and Reserve armored units. The only regular army tank battalions to take delivery of the M48A5 were those in Korea. In conjunction with this program conversion kits were also provided to allied countries wishing to upgrade their Pattons. Eventually some 2000 M48s were converted to M48A5s at the Anniston Army Depot in Alabama

While the M48A5 did not have as good a ballistic protection as the M60A1, in other respects it compared favorably with the newer tank. With the same armament and similar powerplant it provided an excellent backup to the M60. Although never tested in combat, this version of the Patton is essentially similiar to the Israeli M48A4 used in the Yom Kipper War with very good results against Russian made T-55s and T-62s. Based on this it is reasonable to asume that under similiar circumstances the M48A5 would also measure up to what was required of it.

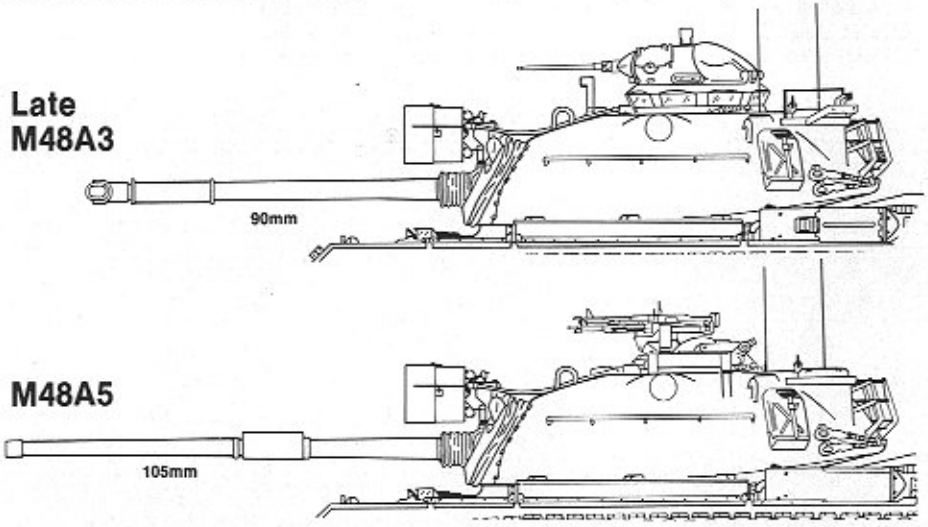
Upgrading the firepower of the M48A3 resulted in the substitution of the M68 105MM gun in place of the old 90MM cannon. However, this test program did not result in orders for the new version due to a lack of spare 105MM guns. (US Army Tank Automotive Center via Binder)

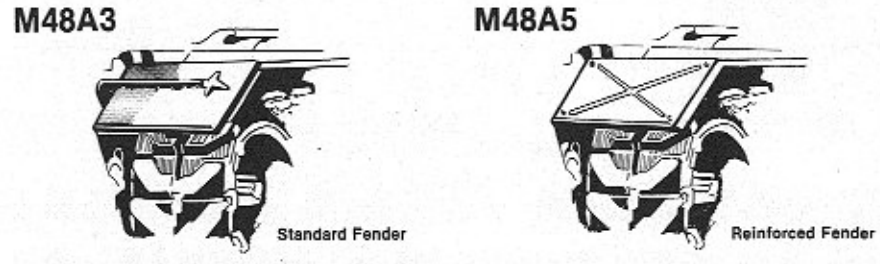
However, after the 1973 Yom Kippur War, US tank inventory levels dropped dangerously low due to large shipments of tanks to the Israelis. In an attempt to quickly make up for this deficiency it was decided to rebuild and re-arm various models of the M48. The new model, designated the M48A5, carried a 105MM gun and incorporated M60 components which brought the variant up to M60A1 standards. The initial production batch was equipped with the M1 cupola G305 turret riser. (US Army via Binder)

On later production M48A5s a low profile Urdan cupola was substituted to lower the overall height of the tank and provide better protection for the commander. This test vehicle, equipped with the new cupola, carries two M60 machine guns in place of the single turret mounted .50 caliber gun carried on the earlier versions. Equipped with the Urdan cupola the vehicle was later designated M48A5 (Low Profile). (US Army via Binder)

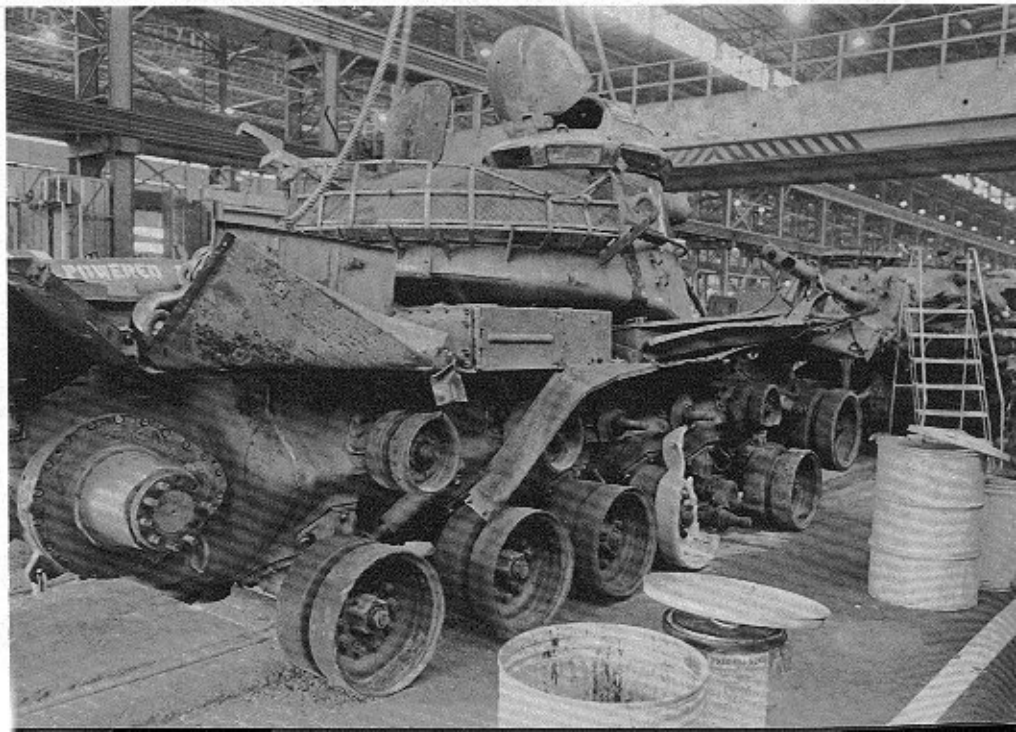


The Urdan cupola superficially resembled the original production cupola used on the M48. This cupola, however, was based on one designed by the Israelis due to their dissatisfaction with the M1 cupola's height and cramped conditions. (Mesko)





Once the decision was made to upgrade the older M48s the Anniston Army Depot began a program to rebuild, and rearm various models of the Patton to M48A5 standards. M48A3s, damaged in Vietnam and in storage, were repaired and rebuilt to M48A5 specifications. (Anniston Army Depot)



(Above) The end result of the Anniston Depot's work. A rebuilt M48A5 equipped with M60 machine guns, a searchlight, and top loading air filters. Eventually over 2000 of these upgraded Pattons were produced. (Anniston Army Depot)

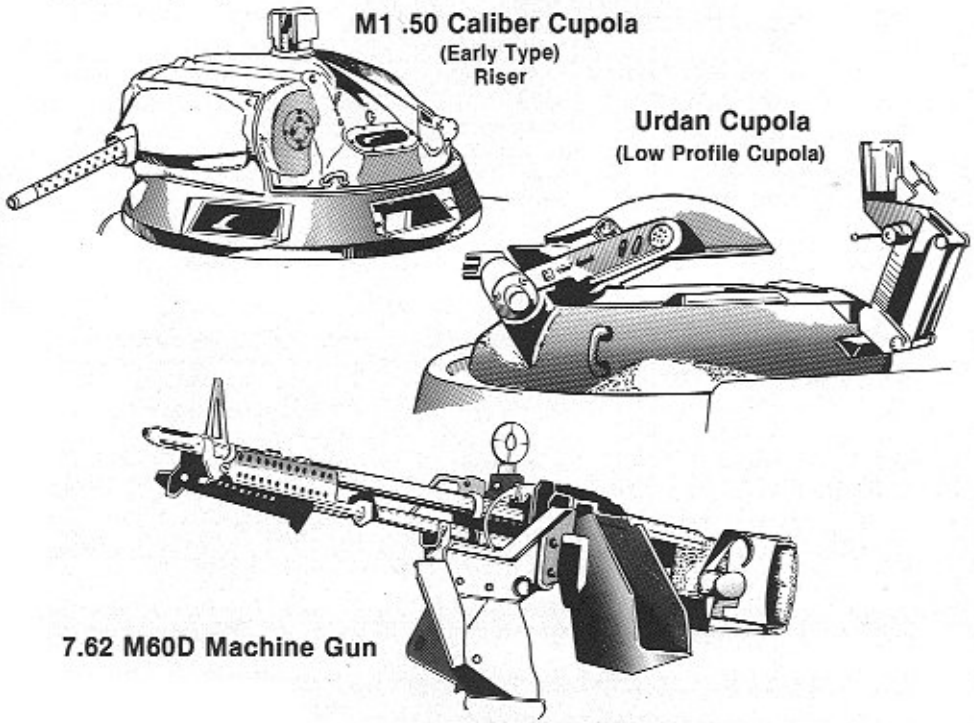
(Left) By the mid-1970s the level of tanks in US inventories had risen dramaticly as a result of the M48A5 program. This line-up of M48A5 (Low Profile) Pattons is at Fort Drum in New York during 1978. (New York National Guard via Binder)

(Below) The majority of these remanufactured Pattons were distributed among various National Guard and Reserve Army units. This M48A5, camouflaged in desert colors, belongs to the 1st Battalion, 149th Armored of the California National Guard. Note the lack of a turret riser which supposedly never was to have happened when the Pattons were re-manufactured. Obviously, there were exceptions to the rule. (Green)

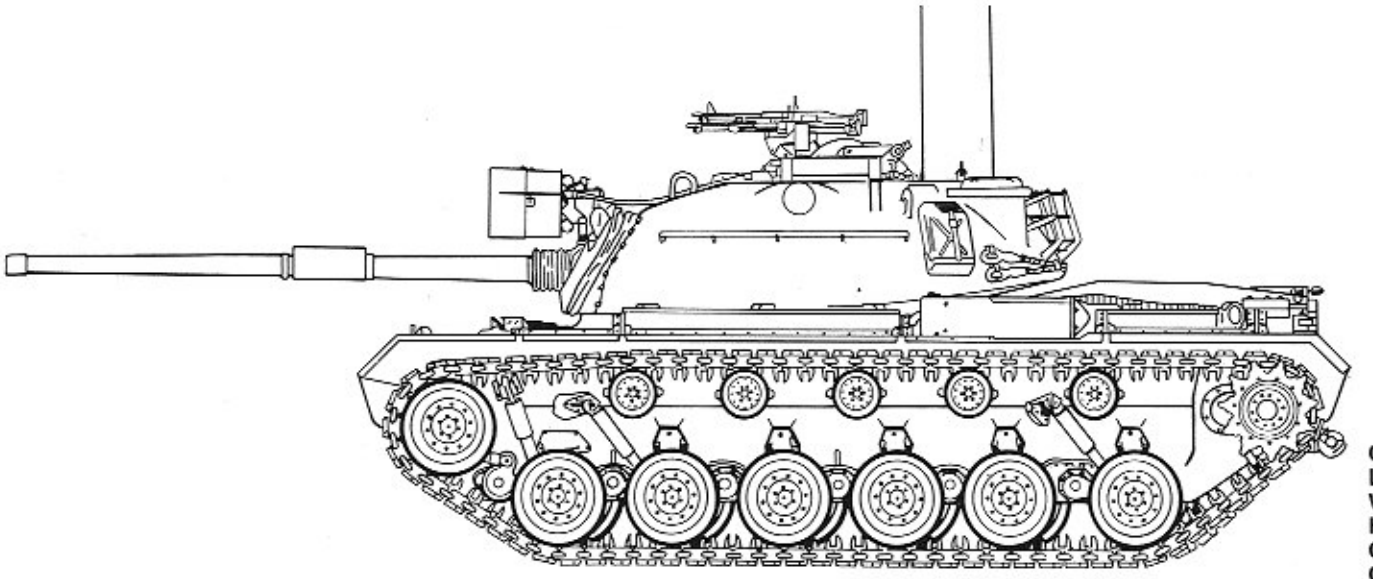
(Above) This M48A5 from the 1st Battalion, 195th Armor, 67th Mechanized Infantry Brigade of the Nebraska National Guard carries a rather unusual legend on its side. (Nebraska National Guard via Binder)

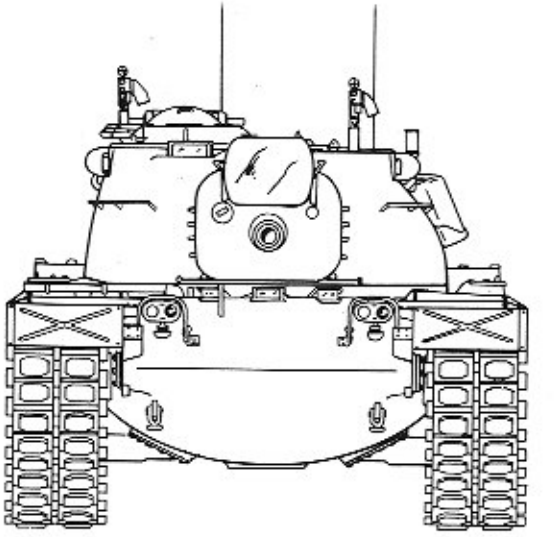
(Above Right) M48A5s have been used extensively in exercises ranging from hot deserts of the Southwest to the snows of the northern states. This M48A5, covered in a mottled snow camouflage scheme, takes parts in exercise Empire Glacier 78 at Fort Drum in January, 1978. (US Army)

(Below Right) Some M48A5s have been sold to American allies or conversion kits have been provided to those wishing to upgrade their older M48s to A5 standards. These ROK Pattons, heavily camouflaged with nets and rice straw, are fitted with smoke grenade launchers on their turrets. The device on the barrels of the .50 caliber machine guns are 'shredders' which disintegrated the wooden core used in blanks to prevent their injuring anyone. These tanks are part of Team Spirit 1983 exercises held between US and South Korean troops. (Wakui via Green)



M48A5 90mm Gun Tank

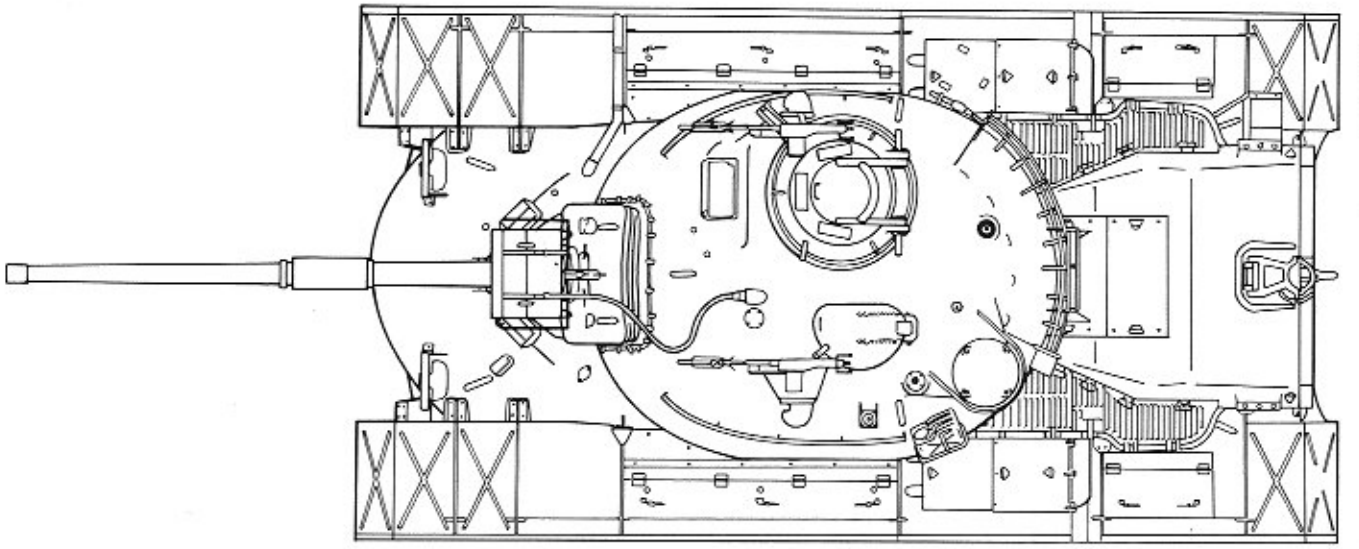


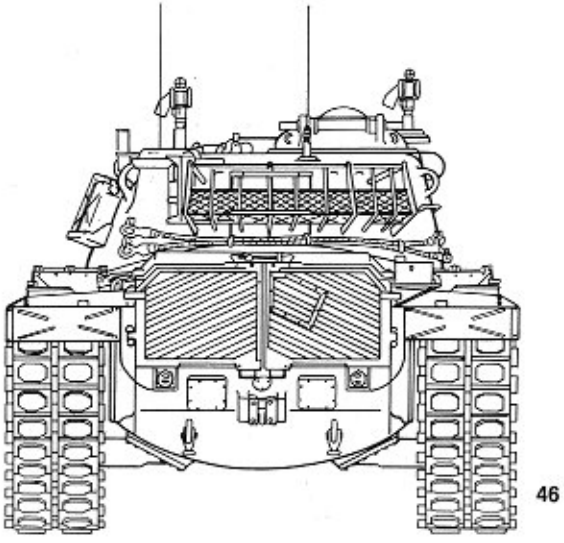


Specifications

90mm Gun Tank M48A5

Crew	4 Men
Length (Gun Forward)	366.4 Inches
Width	143.0 Inches
Height	120.5 Inches
Ground Clearance	16.5 Inches
Combat Weight	108,000 LBS
Armament	
Main	105mm Gun
Secondary	
On Turret	(2) 7.6mm M60D Machine Guns
Co-Axial	7.6mm M60D Machine Gun
Engine	AVDS-1790-2D
Horsepower	643 HP
Maximum Speed	30 MPH
Range	300 Miles





M247 Sergeant York

One of the tanks greatest enemies is the airplane. Airpower's ability to destroy armor has been proven over and over again in World War Two, Korea, Vietnam, and the 1956 and 1967 wars in the mid-East. However, in 1973 aircraft's ability to attack and destroy armor was seriously challenged when the Israeli Air Force suffered heavy losses to a combination of surface-to-air missiles (SAM) and mobile anti-aircraft guns when the Egyptians and Syrians launched their Yom Kipper offensive under a curtain of these weapons. In particular, the Russian ZSU-234 *Shilka* with its radar directed guns, proved lethal to the low flying Israeli aircraft. Following the war, a captured example of the *Shilka* was supplied to the US where evaluation showed both the system's good and bad points. While not overly impressed with the vehicle, the Army realized that its only mechanized air defense vehicle, the M163 Vulcan did not have the ability, even if updated, to deal with Soviet aircraft, especially during inclement weather. Coupled with this came the realization that in future wars American forces might not be able to count on continuous control of the air and might even have to fight under conditions where armored units were under constant aerial assault.

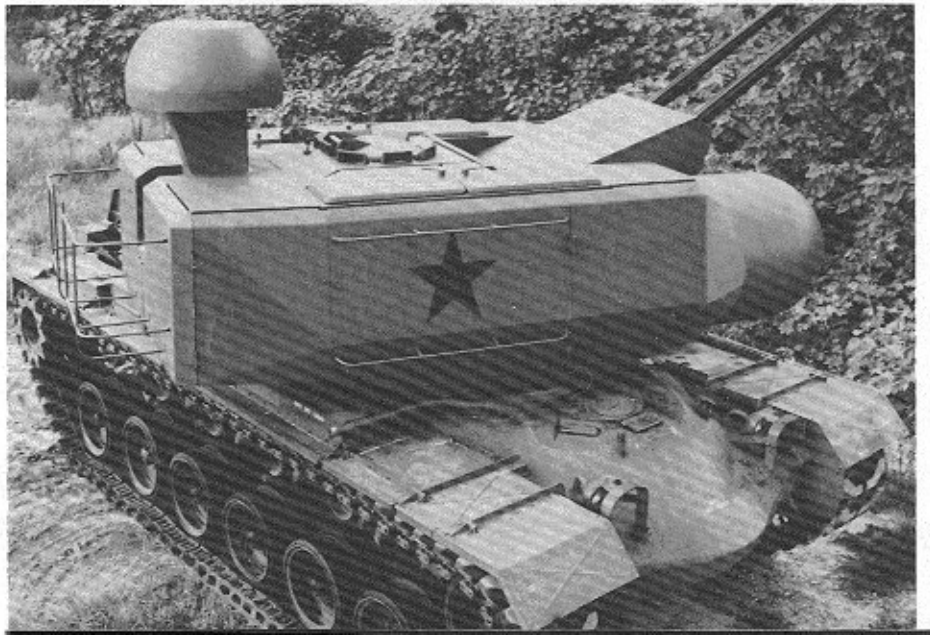
As a result of this the Army funded an experimental vehicle armed with twin 25MM guns to test various fire control systems. These tests showed up the need for heavier caliber weapons, a radar directed fire control system, and an electro-optical backup system. In 1977 the Army asked various manufacturers for proposals based on these requirements with the added stipulation that the new system have as much commonality as possible with current NATO equipment. To speed up the process, the army also directed that the new system could use remanufactured M48A5 hulls, designated XM988s.

From the various proposals submitted, the Army chose the ones from Ford Aerospace and General Dynamics for competitive development and testing of this new Divisional Air Defensive (DIVAD) system. Both entries were similarly designed and configured. The General Dynamics vehicle was armed with twin 35MM cannons and 600 rounds of ammunition in bins by the guns, while the Ford entry had twin Bofors 40MM guns with 698 ready rounds. A modified navy Phalanx search radar was used on the General Dynamics system while Ford employed a search radar based on the same Westinghouse unit used in the F-16 fighter. Both vehicles carried a crew of three, two of whom were situated in the turret. Each also had a redundant electro-optical back-up guidance system in case of damage to the radar unit. In addition, the use of existing, proven sub-components wherever possible allowed the two companies to proceed at a fast pace with their respective test vehicles being ready for trials in 1980.

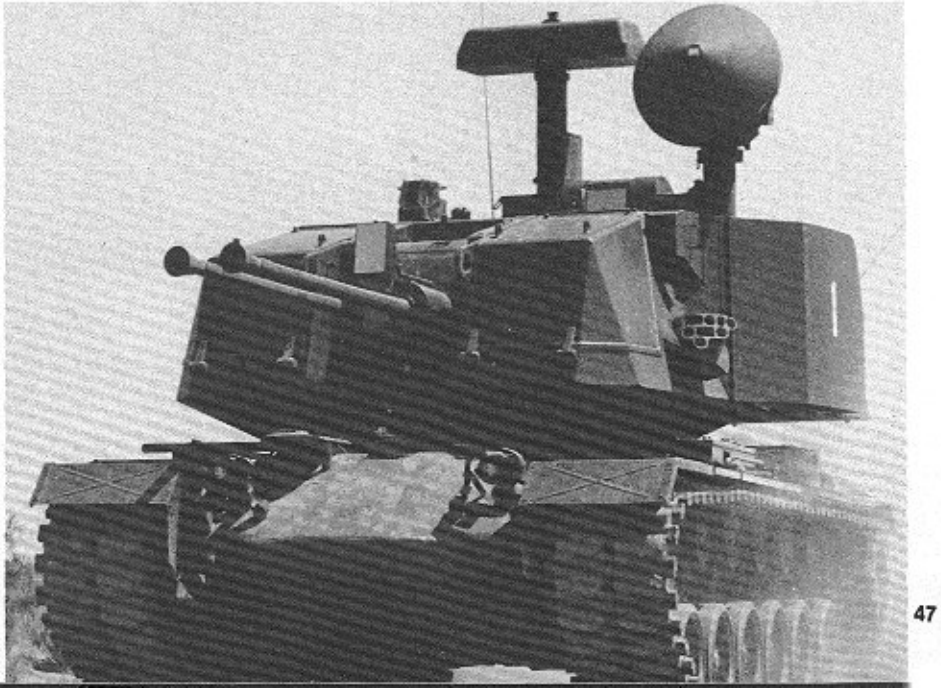
Both systems performed well in tests, but the army chose the Ford entry for its supposedly superior characteristics, despite the fact that the Ford system exhibited numerous faults, which in 1985, still have not been completely worked out. These include being overweight, poor cold weather performance of the control computer, continual failure of the radar fire control system and graphic display unit, unsatisfactory ammunition feed performance, and the need to preheat the hydraulic system, which also leaks. Added to these is the fact that fewer NATO countries are using the 40MM cannon which necessitated opening a new supply line for the ammunition. In fact, the trend among the European alliance seems to be toward the 35MM cannon as used in the General Dynamics version.

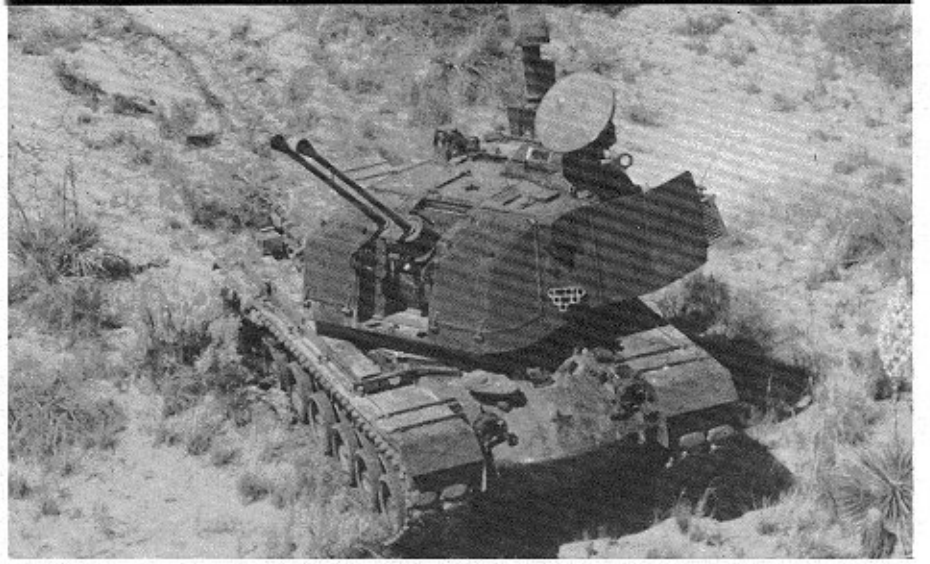
Unfortunately, the decision to choose the Ford model, designated the M247, and nicknamed the Sergeant York, appears now to have been based more on politics, than on actual merit. The new vehicle, still undergoing tests, has yet to live up to expectations. Some testing has even been reduced or stopped altogether. This has caused some concern within the Army and congress since production of the Sergeant York is currently underway, with a number of problems still not completely ironed out. Due to the relatively high cost of the system, its ammunition, and support equipment, the decision for the procurement of 618 vehicles which may be unable to adequately fulfill their mission has raised considerable questions about the program itself and the wisdom of ordering the M247 into production. Ironically, this latest, and probably last version of the M48 Patton series, is experiencing the same problems and criticisms which the early M48s and M48A1s encountered. Only time will tell if this variant will be salvagevable as were its predecessors.

The General Dynamic mockup of their entry in the DIVAD contest. Armed with a pair of 35MM cannons, this design was rejected by the army in favor of the Ford Aerospace entry despite the fact that its armament was more in line with NATO usage than the 40MM guns of the Ford vehicle. There is reason to believe that this decision was based more on political influence than actual military requirements. (General Dynamics via Binder)



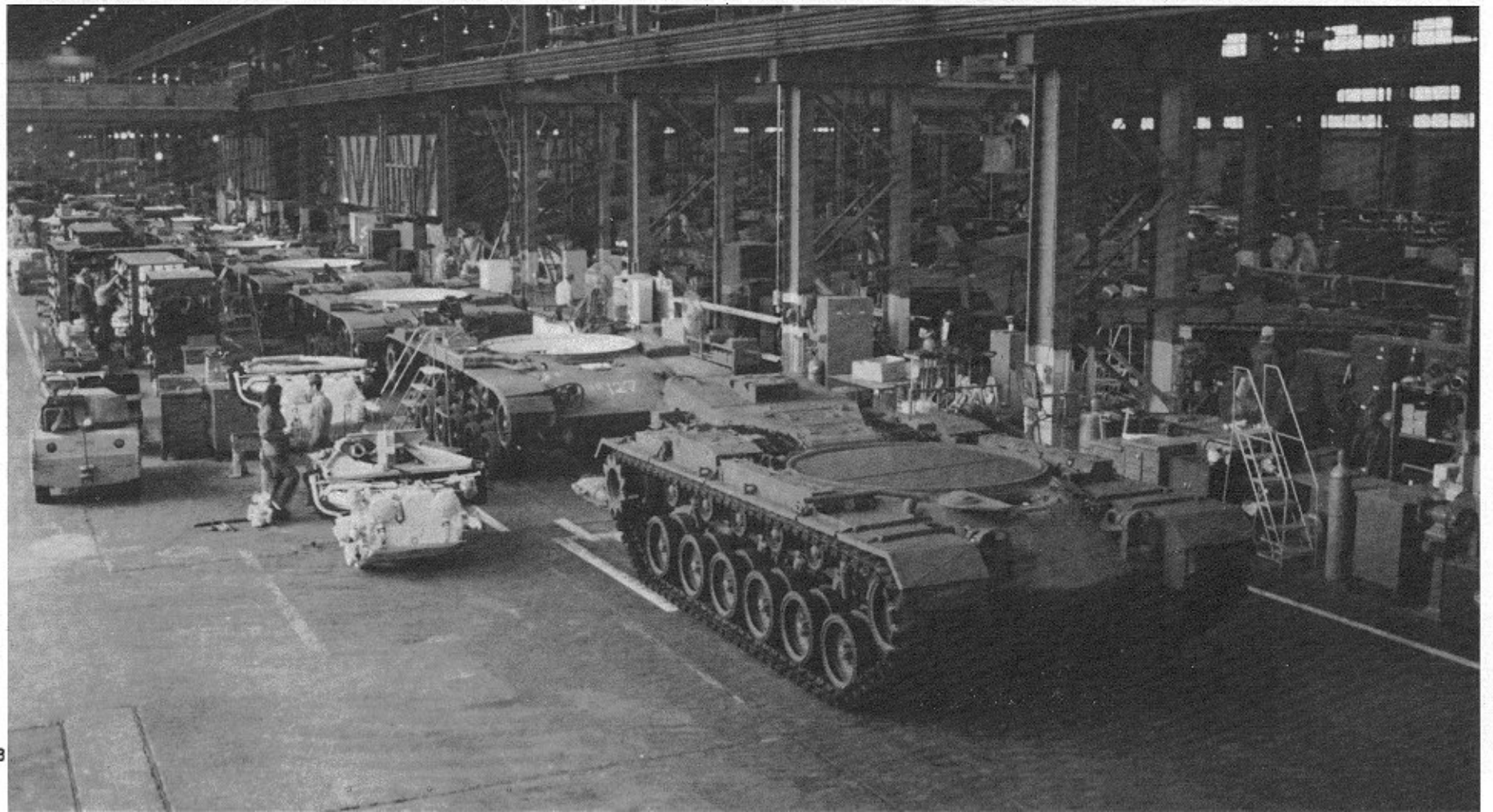
The Ford entry featured a modified radar from the F-16 fighter and twin 40MM cannons along with British style smoke launchers on the turret. Seen here is the pilot vehicle during testing. (Ford)





Designated the M247 and nicknamed the Sergeant York, this vehicle offers several advantages over current anti-aircraft systems employed by the Army. Unfortunately, the Sergeant York also has numerous problems, which as of this writing has yet to be ironed out. (Ford)

Despite these unresolved problems full scale production of the M247 has begun. The first M48A1 hull converted by the Anniston Army Depot to receive the production turret rolls off the line at the depots Building 400 prior to being turned over to Ford. (Anniston Public Relations Office)

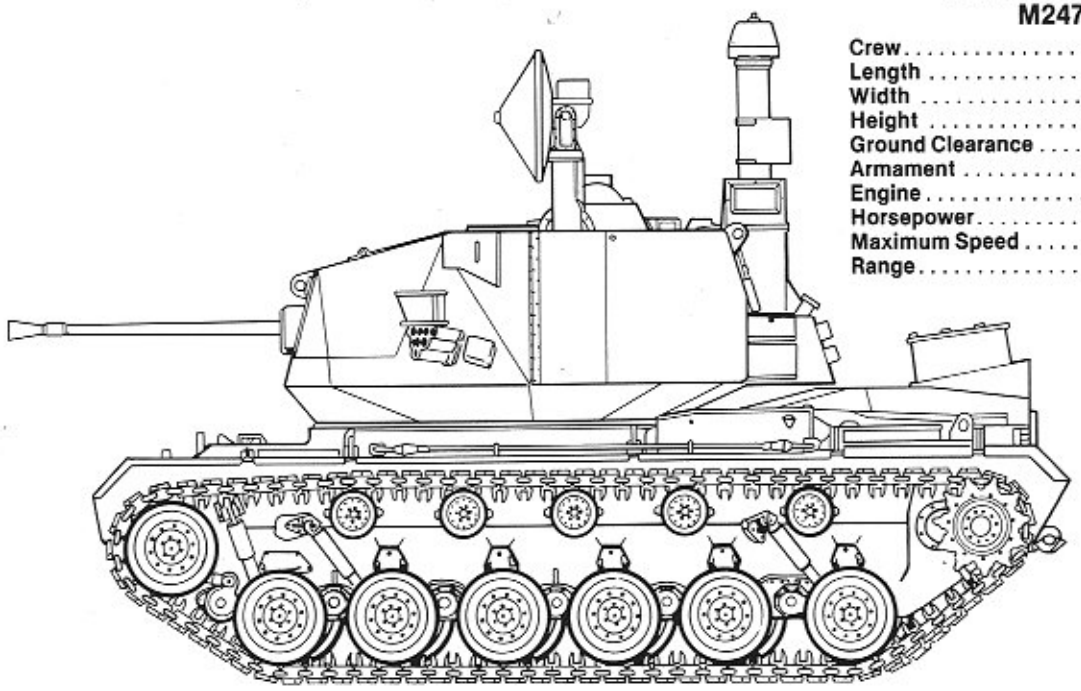


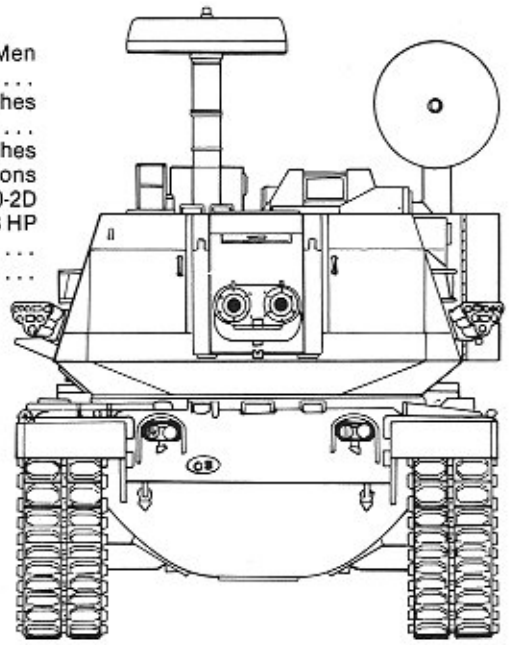
M247 (DIVAD) Gun System

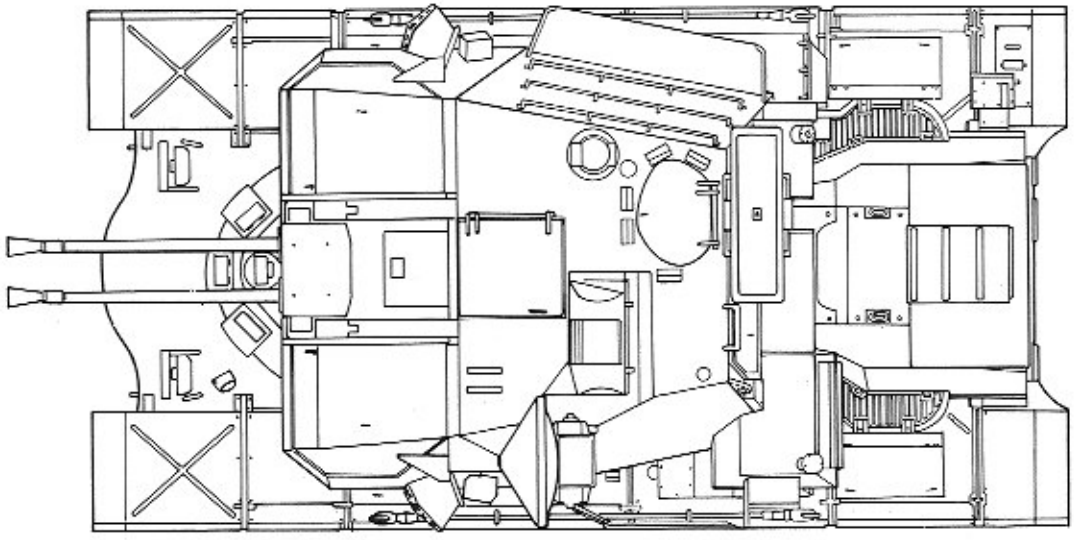
Specifications

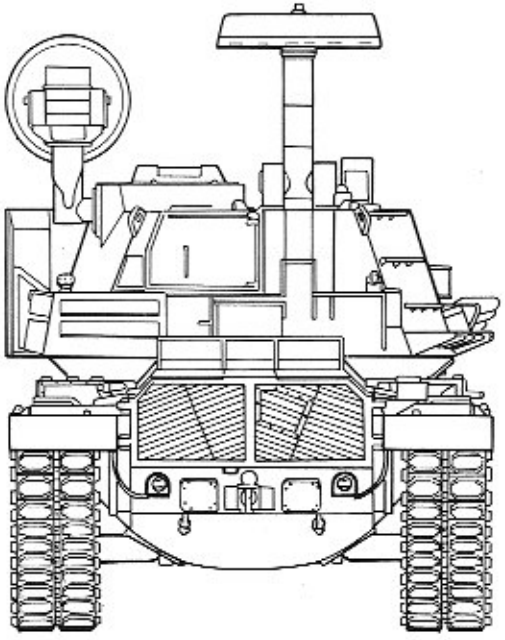
Division Air Defense (DIVAD)
M247 Gun System

Crew	3 Men
Length	
Width	120.5 Inches
Height	
Ground Clearance	16.5 Inches
Armament	(2) Bofors 40MM Cannons
Engine	AVDS-1790-2D
Horsepower	643 HP
Maximum Speed	
Range	









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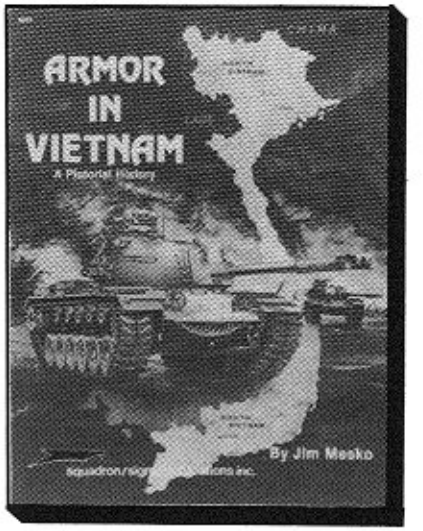

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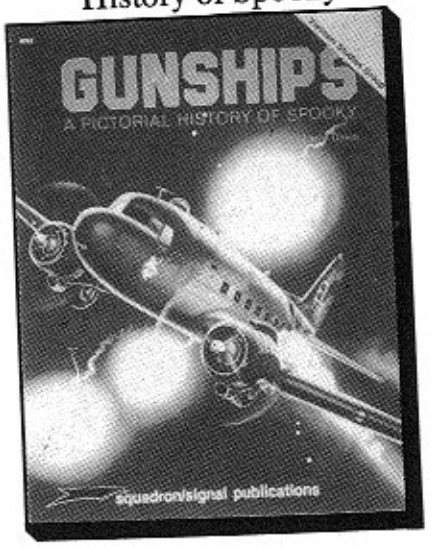

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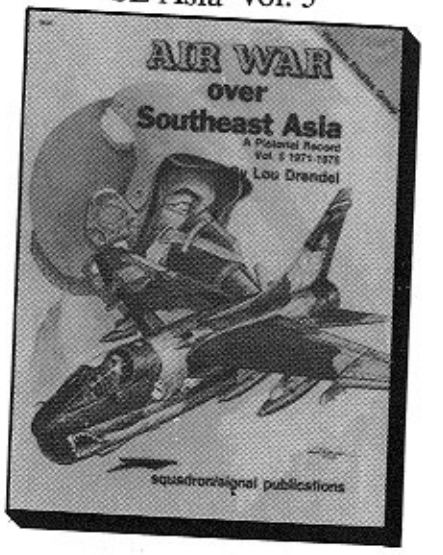

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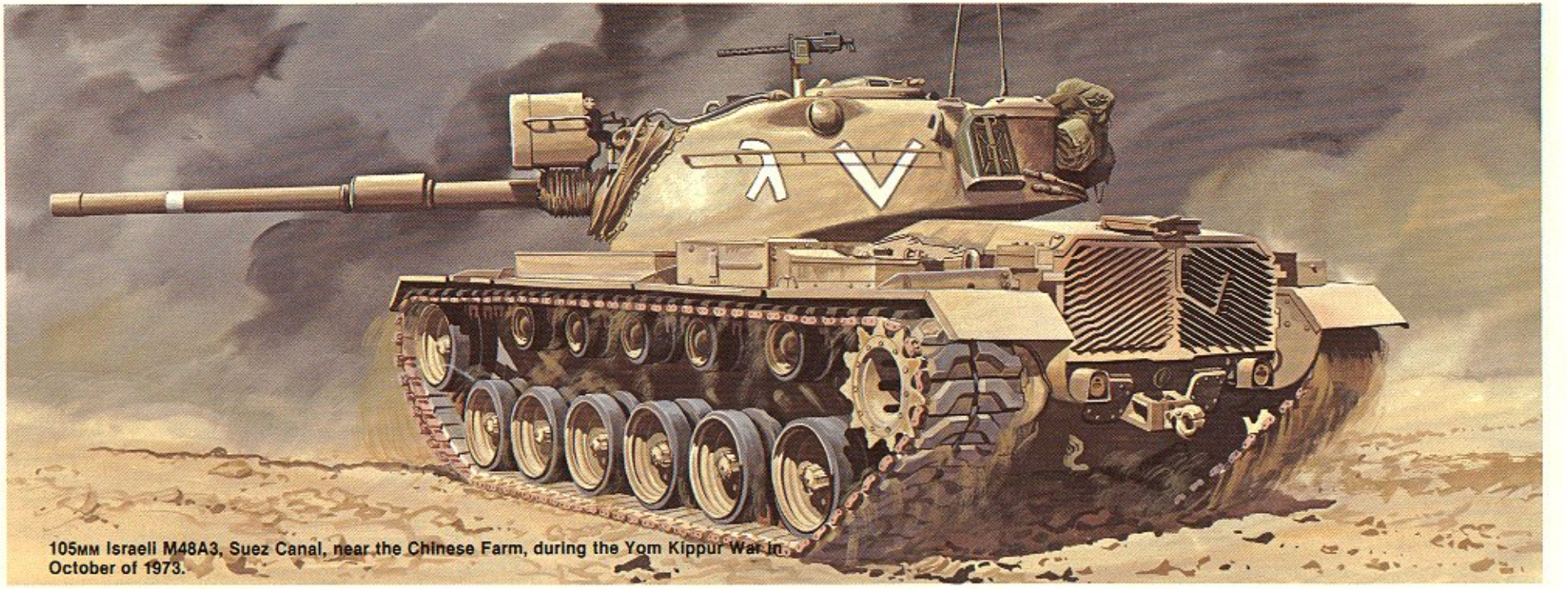
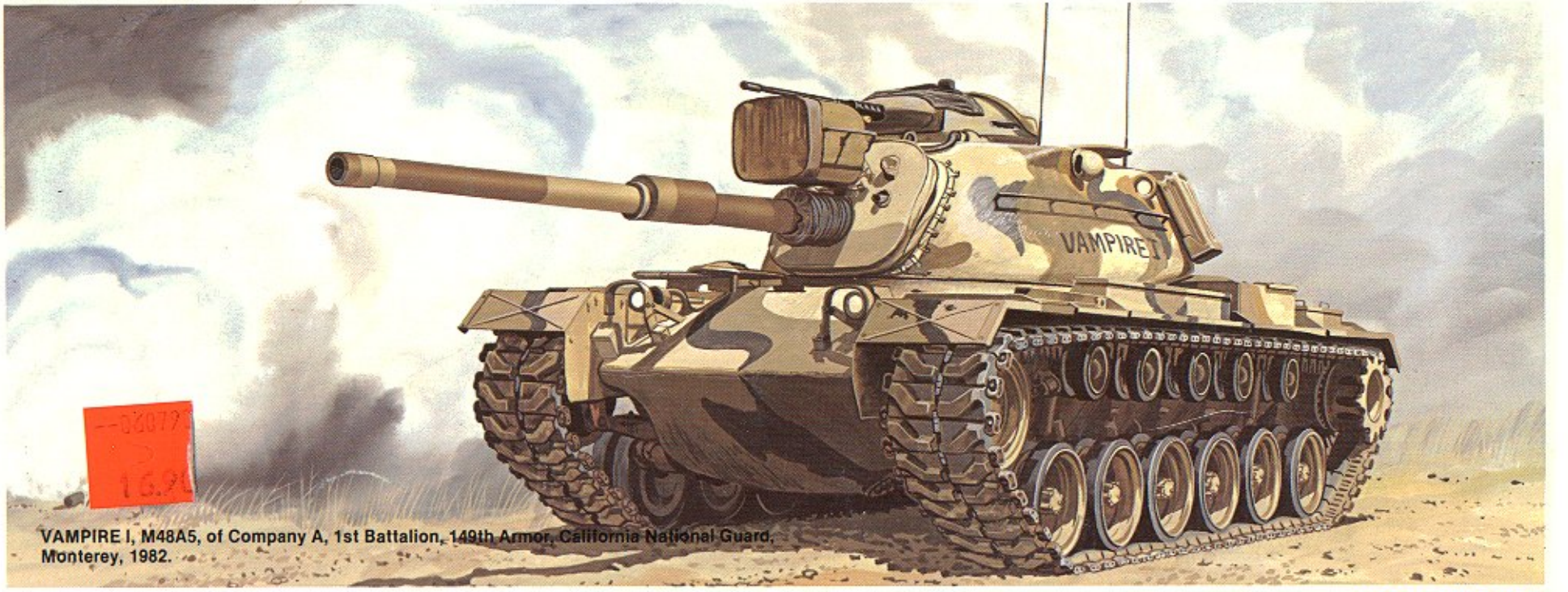


105MM Israeli M48A3, Suez Canal, near the Chinese Farm, during the Yom Kippur War in October of 1973.



VAMPIRE I, M48A5, of Company A, 1st Battalion, 149th Armor, California National Guard, Monterey, 1982.

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